



SATURDAY, AUGUST 10, 1873.

Contributions.

How Long Should an Engineer Remain at his Post?

Under this heading, in a recent number of the RAILROAD GAZETTE, appeared some remarks taken from the journal of the Locomotive Brotherhood. Those words gave expression to a feeling that is growing strong in the Brotherhood, a feeling that cannot be productive of the highest good; therefore any expressions calculated to propagate such views must be regretted—regretted all the more that, as far as the engineer himself is concerned, they are just. When an engineer has done all that can be done there is no necessity for his remaining on the engine, facing eternity; but if this were adopted as a maxim, if every engineer were habituated to the thought that he must do all he can and then jump off, we should very frequently find men jumping off first, forgetting to think of all that is necessary; and who can say when all that is necessary has been done? The instinct of self-preservation teaches men to seek personal safety above all things; but when we appeal to the nobler instincts, and call them into action, they urge men to sacrifice even their lives for the sake of others, which is true heroism. Heroism in battle has, during all ages, been recognized as glorious, and has frequently been amply rewarded. The subordinate is decorated and promoted. A commander backed by all the power of the first nation of the world crushes an Abyssinian chieftain. Behold he rises Lord Napier of Magdala! Another commander with an immense army overwhelms the wretched remnant of a dispirited army. So he is chosen Chief Magistrate of a mighty race! The poor engineer who, nobly facing danger, flinching not, losing not nerve nor presence of mind, lands on the other shore in the very act of saving the lives intrusted to his care—ah, well, he is remembered! Yes! By the ones he loved and by those who loved him. Few more, after a year or so has rolled by, even remember his name. Yet his was heroism not inferior to that of the warrior—nay, far superior. The soldier stands among his comrades, encouraged by their presence and the gaze of his officers, excited by the tumult and the concomitants of battle. The engineer stands alone, unseen, unsupported, amidst the appalling crash of timbers in the certainty of terrible injury if he escape death itself. How much do those who travel by rail owe to the engineer, yet is the debt seldom paid!

During the past month we have had two cases in point, illustrating each side of the question. At the inquest holden after the fearful calamity at Shannonville, on the Grand Trunk Railway of Canada, it was proved that the driver had ample time to jump off; he did not—he died at his post. Not stunned, confounded, incapable from fear, but calmly and resolutely, for it was found that he had done all that was possible to stop the train. We have heard much of the victims and their sufferings, but little of poor Jack Hibbert. The other case was at Detroit, where the engineman of the "Storm" jumped off a little too soon, leaving the engine in "good fighting trim," which resulted in a loss of several thousand dollars more than necessary.

When the soldier dies in battle, his family have a claim on the country; and any special act of heroism brings to them his reward. The railway engineer in the time of danger may think of his family with no certainty that starvation will not overtake them. Would it not be well for managers to consider this subject, whether there should not be some place of rewarding and keeping green the heroic deeds of their employees, not as a matter of sentiment or admiration, but from a strictly business point of view? Let every driver know that if he die at the post of duty his family will be cared for and his name honored. In every instance a memorial of some sort should be erected, a hall for the brotherhood called by his name, a tablet at one of the principal stations, an engine christened after him, etc., etc. Some such means of perpetuating the names of those who have fallen at the post of honor, or who have survived a daring deed, would instill into the hearts of the men a noble, generous heroism that money cannot buy. If such be not done, we shall have the cold calculation of "how little can a man do to fulfill his duty."

HINDOO.

[We believe that "Hindoo" is quite mistaken as to the growth of a sentiment among engineers, whether members of the Brotherhood or not, tending to favor self-preservation as the first duty of an engineman in case of danger. The *Locomotive Engineers' Journal* is full of letters expressing the sentiments of engineers; and we feel sure that their almost universal tendency is to encourage a true soldierly feeling of steadfast observance of duty until death. This seems the ideal which men of this class set up. Of course not all of them are true to their ideal—no more than others are; and we believe there never yet was an army so devoted that some of its soldiers would not shrink at times when they should have faced death. The letter which we quoted simply called attention to the fact that a useless exposure to danger is not a duty, but the contrary. The soldier who exposes himself to certain death for no possible advantage demonstrates his fearlessness certainly, but not his patriotism; for he serves the enemy instead of his country. While the sentiment of self-sacrificing devotion to duty among men who run locomotives should be encouraged to the utmost, they should not cultivate that false heroism

which leads to useless sacrifice. Still, it is no less true that the predominant feeling in case of danger should be devotion to duty; the instinct of self-preservation is usually strong enough naturally.

In what is said as to honoring those who stand or die at their posts endeavoring to do their duty and save the lives in their charge, we heartily agree. The railroads might have their "Legion of Honor," whose decorations would be as nobly earned as any ever won in battle—and as truly respected. But as we never can have the best service until we reward it, so we can never have the noblest service until we honor it. And whatever sentiments of respect we may cherish in our hearts, they will never have their proper and legitimate effect until we make them known in unmistakable words and acts. A marble column on the Hudson River road at the spot where Doc Simmons died with his hand on the throttle-valve lever would be an inspiration to every train-man every time he passed it, and—who knows—might be the indirect means of saving more lives than were lost at that great disaster, by its effect in encouraging self-devotion in the line of duty. We hope corporations with souls—and there are some—will think of this. We are sure that they will serve themselves and the community by publicly honoring—not simply rewarding—those who stand steadfastly at their posts in imminent peril or till death.—EDITOR OF THE RAILROAD GAZETTE.]

Locating Frogs and Switches.

LOMBARDVILLE, Stark Co., Ill., July 10, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice some new formulae upon the subject of frogs and switches. That in the number of June 15 is new to me. Of the one in number of June 22 I have seen the main part before. "G. C. B." says that formulae are not generally needed. I think, on the contrary, that they are valuable to engineers and also to trackmen sufficiently educated.

It is not a good plan to trust the calculation of frogs and switches to section or trackmen. A table is what they need; calculated by the engineer; and he should see that the calculations are followed. The effects of the failure of the engineers to give their calculations is evinced in broken-backed turnouts all over the country, and by run-off by striking points of frogs of improperly laid side tracks.

The formula given by "G. C. B." which differs from the truth only in the difference between the tangent and the sine of the frog angle, is found in the number of June 1, and also in the number of March 25, 1871, that is: $D+S=2 \times g \times l$, and his deductions are plain by inspection of the table; however, to those who do not comprehend signs, there is some advantage in putting formulae into words.

A formula for finding the distance from heel of switch and point of frog is very well, but there are three points to determine, and the heel of the switch is the least essential. The head block or toe of switch and the point of frog are the most essential.

No formula or table for frogs and switches is valuable unless it enables you to calculate the position of the head block. Now that, of course, depends upon the movement of the rail, and that varies upon different roads, although 5 inches is most generally used.

If I am asked to locate a 1-10 frog for a 3-foot gauge, and should give formula $2 \times 3 \times 10 = 60$, my information would be very partial and unsatisfactory unless I also should give position of switch stand, and that could only be done by having the movement or throw of the rail given.

Formulae are valuable, because they enable us to calculate simply the same things under varied circumstances and cases, and without forcing us to keep booked upon calculations which would exclude us from more important work.

L.

The Accident at Green Brier Bridge.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As I have always advocated publicity as to the causes of railway accidents, I now take the earliest opportunity of stating the facts in regard to the fall of a temporary wooden trestle work, built by the firm of which I am a member, over the second crossing of the Greenbrier River, on the line of the Chesapeake & Ohio Railroad, in West Virginia.

There are two crossings of this river, about six miles apart; one of four spans of 105 feet; the second, four spans of 120 feet each. The track is about forty-five feet above the bed of the stream, in which there was from one to two feet of water, over a bed of small boulders. In order not to delay the track-laying, it was decided to trestle all of the eight spans, so as to carry trains and erect the iron bridge simultaneously. The iron spans were to be deck bridges, of the usual Phoenix pattern, with vertical posts and inclined tie rods, with about 16 feet depth of truss.

The eight spans were accordingly trestled with timber, according to the following plan: Each span was divided by eight bents, standing about thirteen feet apart. These bents consisted of two vertical and two leaning posts, 10x10, framed upon a mudsill below, 10x12, resting on the stones of the river bed, and having a cap above, also 10x12. On the tops of the caps were four rows of longitudinal girts, extending from pier to pier and butting against the masonry by means of plank spiked to them. These girts were pinned to the caps with oak trenails. Upon these caps stood the posts of an upper tier of bents of the same size, and about 20 feet long. These were again capped, and upon them lay the track stringers in position as they were finally to be used on the iron bridge; upon

the track stringers lay a temporary track of ordinary hewed ties.

Each bent was well braced transversely, but there were no diagonal braces in the direction of the track.

Such a trestle work will stand very well if there is no settlement of foundation, as is shown by the fact that seven of the trestled spans carried iron trains safely until they were replaced by the permanent bridge.

Two of the bents of that span which stood in the deepest water were observed to have settled slightly out of level. They were blocked up by placing timbers and stones under the mudsills.

A number of trains of iron rails had crossed this trestle safely, when a further settlement of these bents was observed. The place was examined and pronounced safe; on the passage of the next train, however, the whole thing gave way and came down, the bents shutting up at the joints like a jack-knife, as it was described to me by one who saw it.

This unfortunate accident was clearly owing to a settlement of the foundation under the mudsills of two of the bents.

If the blocking had been placed above the lower bent, and it driven down to a firm bearing, instead of trying to block it up from below, the settlement would probably have been permanently checked.

It is possible that even after a settlement had taken place the fall of the bents might have been prevented if they had been well braced longitudinally, but this cannot certainly be known.

Strange to say, not a stick of timber was broken. It was all gathered up and re-erected on the same place as before the fall, and is now carrying iron trains in safety. It is believed that the persons who were killed were struck by falling timbers, as the locomotive came down upright on its wheels, and was but little injured.

T. C. CLARKE.

[We take occasion to commend this frank and intelligent account of the causes of the failure of a structure. If every railroad accident were explained and discussed there would be fewer of them; and we can easily see how Mr. Clarke's exposition of the mistake made in blocking up the mudsills of this bridge may put hundreds of engineers all over the country on their guard against a similar mistake.—EDITOR OF THE RAILROAD GAZETTE.]

Trial of Another Fairlie Locomotive.

Engineering of July 12 contains a very interesting description of the Great Luxemburg Railway, and of a trial of a new Fairlie engine just placed upon that line by the Chairman of that company, Mr. William Fenton, for the purpose of reducing the wear upon the permanent way, and to increase the capacity of the line. After careful investigation he decided to place a Fairlie engine upon the line "to ascertain how such a machine would fulfill requirements of which the existing stock was incapable." The engine and trial are thus described by our contemporary:

It is carried upon 12 wheels 3ft. 6in. diameter, grouped under two steam bogies, the cylinders of which are 15in. diameter and 22in. stroke; the wheel base of each bogie is 8ft., the total wheel base being 29ft. 6in. The boilers are 3ft. 10in. diameter and 10ft. 9in. in length. The fire-box heating surface is 140 square feet, and tube heating surface is 1,550 square feet, there being 286 tubes 1 1/2 in. diameter; the grate area is 24 1/2 square feet. The engine carries 2,200 gallons of water, 2 tons of coal, and in addition 450 cubic feet of wood if required. Its weight in running order is 60 tons.

After having been erected and put under steam, the engine, called the Fenton, after the Chairman of the company, made several trips out of Brussels, carrying behind her train loads varying from 450 to 480 tons, which she took with ease up the bank of 1 in 60 between Brussels and Ottignies. As it was desired that various French and Belgian engineers should have an early opportunity of inspecting the engine, it was decided by the Luxemburg Railway Company to run a heavy train through from Namur to Arlon, a distance of 94 miles, and back to Namur. It was determined, however, to start with a load of only about 400 tons, and with this load the engine left Namur at 12:20 p. m. on Tuesday, the 3d July. The whole of the first day's run was marked by a series of mishaps, much to be regretted, because a little preliminary care on the part of the builders would have prevented them. In the first place, before starting, both of the injectors (Friedman's) refused to work—a similar incident occurred on the trial of the Mexican engine in February last on the Grange Colliery incline (see *Engineering*, page 94, vol. xiii.) After considerable delay one of the injectors was coaxed into operation, and a start was made up the long 4 1/2 mile bank of 1 in 60 just outside the town. The train was composed as follows:

	Tons.
Twenty-six wagons weighing collectively.....	135
One first-class carriage and brake van.....	15
Freight in wagons.....	259
Twenty-two passengers, etc.....	3
Weight of engine.....	419
Total.....	60

Up the first bank the engine proceeded with the greatest ease at a speed of about 9 miles an hour, making steam freely, and blowing off at 130 lb. whenever the injector ceased working. The same steady speed and steam pressure were maintained to the top of the bank, when the train was stopped at the Nanettes station. Arrived at Nanettes, it was found that one of the coupling rod ends, and a cross head, and slide bars of the rear bogie had run extremely hot; this was the second untoward incident. After three-quarters of an hour's delay, a start was made for the next long bank of 1 in 60, near the top of which is the Assesses station. After twenty minutes easy running, the one injector, which till that time had behaved well, stopped suddenly, and it became necessary, after a few minutes, to drop the bars from one of the fire-boxes; after a considerable delay the engine ran on alone, at a reduced steam pressure, to the Assesses station, the injector having started work again. The train was afterward brought to Assesses by other engines, and most of the visitors went forward by passenger train to Arlon, leaving the Fenton to follow with her load as soon as her bars had been replaced and steam got up. This was quickly done, and the freight train was carried forward to Jemelle without further mishap, excepting the increased heating in the rear bogie. We should here state that one of the heavy freight engines of the ordinary pattern followed the Fairlie train, in order to arrest any of the wagons in case the couplings should yield, a contingency much feared,

and to avoid which was the principal reason for keeping down the weight of the train to the amount named above. It was proposed to remain at Jemelle during the night, in order to look after the injectors, and take means, if possible, for preventing the engine from running hot the next day, and to start the following morning with a heavy train up the long incline to Libremont. The proposal was, however, overruled, and at 6 p. m. the Fenton started with a train of 383 tons up the bank, the following engine being still retained.

Soon an unaccountable slipping of the rear bogie commenced, and continued persistently, which threw most of the work upon the forward pair of cylinders, there being no means of throwing sand upon the rails in front of the rear bogie, the sandboxes being placed upon the top of each smoke-box. Just before reaching the Poix station it was found that the tanks which had been filled at Jemelle were empty, and on stopping the train the cause of this, as well as of the slipping, was discovered. The pipe connecting the two tanks, and which was provided in the middle with a short nipple closed with a screwed plug, had been struck by the broken stone ballast, the plug was carried away, and the water from the tanks was discharged on to the road, and over the rails. This accident was caused by the connecting pipe having been carried below the rear fire-box, instead of at the side, so that it projected down nearly to the ballast. After some trouble the pipe was stopped with a temporary wooden plug, the following engine was brought round to the head of the train, and a start was made for Arlon, which was reached about 12:30 a. m.

During the night the valve-boxes of the feed-pipes were taken off, and the valves altered, a new screw-plug was fitted to the tank discharge-pipe, and some measures were taken to prevent the heating, which had so interfered with the previous day's performances. At 9:5 a. m. on Wednesday, the 3d, the Fenton left Arlon with a still lighter train than it had taken the previous day, the gross load being only 326 tons. With this load she proceeded to Namur, the following engine being kept in attendance, and employed occasionally when there was no steep ascending gradient, in order to save time, it being impossible to run at any greater speed, on account of the heating. Namur was reached about 6 o'clock in the evening, and the engine has been since taken to Brussels to undergo the numerous alterations rendered necessary, either by faults in construction or erection, before she can be placed in regular work.

Although the trip was marred by a succession of mishaps, the efficiency of the engine was very thoroughly appreciated by all who were present, the drawbacks being unanimously and justly ascribed to the makers and not to the designers nor to the principle. One point was especially noticed by those gentlemen who had ridden for the first time on the footplate of a Fairlie engine—the extreme steadiness of running.

THE MASTER MECHANICS' ASSOCIATION.

Official Report of the Fifth Annual Convention.

THIRD DAY.

[Concluded from page 335.]

EVENING SESSION.

NEW ASSOCIATE MEMBERS.

The report of the Committee on Associate Members was read, and, on motion, the Association proceeded to ballot for the candidates for membership.

F. B. Miles, of Philadelphia; R. H. Thurston, of Hoboken; Henry Morton, of Hoboken, and J. O. D. Lilly, of Indianapolis, were elected.

Mr. James Wheelock, of Worcester, being proposed, a member inquired if any person present was acquainted with Mr. Wheelock.

The SECRETARY—I would inquire if the provisions of our constitution permit Mr. Wheelock to be a member of the Association; whether he comes within the constitution.

The President read the second section of the fourth article of the constitution prescribing the qualifications for membership.

Mr. HAYES, Illinois Central Railroad—It seems to me that some one present ought to be able to say whether this gentleman has the qualifications necessary to become a member. It seems there is no one here that knows him.

The PRESIDENT—Mr. Wheelock was recommended by Joseph Hill, Richard Colburn and A. B. Underhill. I heard those gentlemen speak of him very highly. They spoke to me about him before he was proposed to the Committee. I think none of them are present. They said they knew him, and he would be a valuable member.

Mr. Wheelock was then elected.

D. R. Tighe, recommended by George W. Glass, J. K. Taylor and L. Moore, was submitted for ballot.

Mr. TAYLOR—I know the gentleman and he is a good, worthy man. He is not engaged in mechanical business now, but is advocating the Nesbitt balance-valve. His home is in Boston, and his former business was machinist.

Mr. HAYES—Has he ever filled the position of master mechanic?

Mr. TAYLOR—No, sir.

Mr. HAYES—Is he a thorough mechanical engineer?

Mr. TAYLOR—He is.

Mr. GORMAN, Toledo, Wabash & Western Railway—I think we are establishing a precedent that will not work well in the future. We want here, if I understand it, four or five, or perhaps more, chemists or scientific men, that can give us information that we do not possess ourselves regarding the formation of scale, and other necessary information that will be very valuable to us; but to go into an indiscriminate election of gentlemen who want to sell packing or anything else, I don't believe is going to be a good thing for us. I think we ought to confine ourselves to the purposes of the Association—the American Railway Master Mechanics' Association. We don't want every man that comes along. This gentleman may be a good, worthy man, much better than I am; but, at the same time, as we have got this Association, I think we ought to confine ourselves to that. If we want information that will be valuable to us by getting in professors of chemistry or others that can give us information that will benefit the whole railway interest of the country, I say bring those men in.

Six negative votes were thrown and the candidate was rejected.

The Secretary read a letter from Frederick Grinnell, which, on motion, was received and ordered to be spread on the minutes.

LETTER FROM MR. FREDERICK E. GRINNELL.

PROVIDENCE, June 13, 1872.

J. H. Setchel, Esq., Secretary American Railway Master Mechanics' Association.

DEAR SIR: I am in receipt, at your hands, of the engrossed copy of the resolution passed at the fourth annual convention held at Louisville, in acknowledgment of the services of myself and others in establishing the "American Railway Master Mechanics' Association."

I thank the members of the Association for the compliment paid me, and although not likely to be again associated with them as a railway master mechanic, I shall always feel a deep interest in the success of an organization which must be of so great benefit to its members, and through them to the entire railway interest of the country.

In no department of railway management is there so great need of comparison of the results of practical experience as in the mechanical department, owing mainly to the multitude of questions involved, both as to the kind of material to be used and the proper methods of disposing of it.

Any railway officer who has carefully examined the reports of the conventions which have been held must be convinced of the interest manifested by the members of the Association in the important work in hand, and, if true to the interests of their companies, assist them in their efforts in every way possible.

With sincere wishes for the continued success of the American Railway Master Mechanics' Association, I am very truly yours,

FRED. E. GRINNELL.

The report of the Committee on Boiler Explosions was presented. On motion of Mr. Gorman, it was voted to dispense with the reading of the report in detail, as it would be published in the report.

Mr. HAYES, Illinois Central Railroad—I would move that we read simply the conclusions arrived at by the Committee. Agreed to.

Mr. HAYES—I was going to suggest that Mr. Sellers is present. I understand he witnessed the experiments made at Hoboken, a year or two ago, on the explosion of boilers. They took a lot of boilers and exploded them for the purpose of ascertaining, as nearly as they could, the true cause of explosions. I understand that Mr. Sellers was one of the committee who witnessed it. If he is present, I would like to hear from him on the subject. If he is not here, I would move that the discussion be dispensed with for the present on that subject, and that we proceed with something else until he comes in.

Mr. GORMAN, Toledo, Wabash & Western Railway—Before that question is put I will say I differ with Mr. Hayes. This is a very important matter, this question of boiler explosions. It is something of great importance, and it is getting to be more important every day; and by spending a little time on this I think we can do it with great advantage. By the time that some of our members can explain this and give their views, Mr. Sellers may be here. I don't think we can spend our time to any better advantage than by trying to find the source of boiler explosions and burnings. It has come to be a question that is agitating the whole country—in steam mills as well as on roads. We hear of boilers in all sections of the country blowing up, and we ought to have sense enough among all of us to be able to discover the cause of this thing. We never will do it alone; we want to get the judgment and sense of the whole country upon it. I differ with a great many in regard to explosions. I have never seen but one. I have seen three bursts. I claim there is a great difference between the bursting of a boiler and the explosion of a boiler. I am not chemist enough and don't pretend to know what the actual cause of an explosion is, but I am under the impression that it is a combination of gases that ignite in the boiler, that are diffused through the boiler. That is my impression. It may be wrong and may not. I will not say I am right. The bursting of a boiler I have seen in three cases where I could trace the cause. I felt satisfied that I could, and do now, in my own mind. The last I knew of was on my own road. There is a peculiar theory in my mind in regard to the bursting of boilers, which is simply that there is a latent heat that accumulates in the water in the boiler. You can stand the boiler still and not disturb the water, but as soon as you disturb it there will be innumerable bubbles of water come to the surface. I have tried that in a boiler on a small scale. You can try it yourselves. It will flash out immediately; and if the safety-valve is not sufficient to allow an escape, there is danger of a burst.

The PRESIDENT—The question is on Mr. Hayes' motion, and not on boiler explosions.

Mr. GORMAN—If we could keep on with this little discussion until Mr. Sellers comes I think it would be a benefit to us. I offer an amendment, that we continue the discussion until Mr. Sellers comes in.

The amendment was lost, and the motion agreed to.

The report of the Committee on a Uniform System of Examination for promotion of Locomotive Firemen was presented.

REPORT ON UNIFORM SYSTEM OF EXAMINATION FOR PROMOTION OF LOCOMOTIVE FIREMEN, AND ADVISABILITY OF ESTABLISHING DIFFERENT GRADES OF LOCOMOTIVE ENGINEERS.

To the American Railway Master Mechanics' Association.

GENTLEMEN: Your Committee appointed at the last annual meeting of the Association to report on the propriety of a "Uniform System of Examination for Promotion of Locomotive Firemen," also as to the "Advisability of Establishing Different Grades of Locomotive Engineers, according to Length of Service, Character, etc." beg leave to submit the following:

From answers received in reply to circular letter containing the following questions:

"1st. What is your method of promoting locomotive firemen to engineers?"

"2d. What has been your experience as to the relative merit of locomotive engineers promoted from firemen as compared with those taken from the shop?"

"3d. What are your views upon establishing different grades of engineers according to length of service, merit, etc.?"

"4th. Please state compensation allowed engineers, whether paid by month, trip or day, also amount of service rendered for same?"

1st. Your Committee find that the prevalent practice is to select from among the firemen who have fired from two and a half to three years at least, one who by his record, as regards sobriety, attention to duty, intelligence and general character, gives best promise of becoming a valuable and reliable engineer in a short space of time; to give him from six months to a year's time in the shop, with occasional calls for duty on such extra running as will familiarize him with his prospective duties, and at the same time keep him as much as possible under the eye of the master mechanic, and when deemed competent an engine is given him to run.

2d. Your Committee also find that, though wherever tried, the promotion of shopmen to locomotive engineers has in a measure given good satisfaction in the item of the cost of running (repairs being somewhat less than with the promoted firemen), yet, because of their being possessed of the two trades, they are considered not so reliable and are less attentive and obedient to orders, and so likely to give more trouble than promoted firemen.

3d. Your Committee find in the majority of the replies that a uniform system of "grading engineers" according to "length of service" exists, consisting in a division into four classes; commencing with the first and continuing through the first three years of service, when an engineer is considered first-class and is paid accordingly.

We also find that on several roads an additional reward for length of service after five years is given in an increase of pay of five dollars per month every five years.

4th. As reported to your Committee in answer, it appears that though in many instances the compensation for services is computed by the month, yet the average service required is about one hundred miles per day, and pay ranges from \$3 to \$4.25 for same.

We have received no reply as to a uniform system of "examination for promotion," except in two or three instances, and those opposed the idea.

Your Committee would suggest a uniform system of letters of recommendation for locomotive engineers, consisting of a printed blank to be filled out by the Master Mechanic, stating length and class of service, cause of leaving, and general standing of the person holding the recommendation.

N. E. CHAPMAN, } Committee.
W. F. SMITH, }

The PRESIDENT—There was referred to the same committee the subject of the Advisability of Establishing Different Grades of Locomotive Engineers, according to Length of Service, Character, etc.

On motion of Mr. Maynes the report was accepted and placed on file.

Mr. CHAPMAN, Cleveland & Pittsburgh Railroad—Attached to that report was a letter from Mr. Isaac Dripps, which I think perhaps it would be well to read in connection with the report, if the members see fit.

Mr. MAYNES, Selma, Rome & Dalton Railroad—I move that it be received and placed on file. I would also inquire whether it will be published in the proceedings of the Convention? Whether placing it on file insures its publication? I think the letter of importance enough to be printed.

The PRESIDENT—Yes, sir; the understanding is it will be received and printed with the report. The motion was agreed to.

LETTER FROM ISAAC DRIPPS ON PROMOTING FIREMEN AND GRADES OF ENGINEERS.

ALTOONA, Penn., June 8, 1872.

Mr. J. H. Setchel, Secretary American Railway Master Mechanics' Association:

DEAR SIR: The circular from the Committee appointed to inquire into the propriety of a uniform system of examination for promotion of locomotive firemen, etc., has just been read by me. As the subject is one of importance, I at once reply. Not having time to reach the Chairman of the Committee before the sitting of the Convention, I send to you, for its proper disposal, this letter giving my views and the result of my experience upon the subjects of the circular, as follows, in answer to the following questions:

"What is your method of promoting locomotive firemen to engineers?"

"What has been your experience as to the merits of locomotive engineers promoted from firemen or taken from the shops?"

"What are your views upon establishing different grades of engineers, according to length of service, merit, etc.?"

"Please state compensation allowed engineers, whether paid by the month, trip or day; also amount of service rendered for same."

I would say that my practice has been as follows:

In the first place, I pay particular attention to the selection of young men for firemen, selecting none but smart, active young men, of good character and perfectly sober habits. After firing for about three years, if they give evidence of sufficient capacity and carefulness, I place them in the repair shop or round house for one year, to enable them to learn the use of tools, but more particularly to become acquainted and familiar with the construction of the locomotive engine and the manner and mode of taking its machinery apart and putting it together again, and pay them the same as firemen, or whatever they are worth as men working in the shop.

During this year, while in the shop, they are considered as extra young engineers of the third class, and are available to go out upon the road in cases of emergency, and while out on the road receive the pay of third-class engineers. If at the expiration of the year they do not develop evidence of capacity to make efficient engineers they are not promoted, but either continued as ordinary firemen or dropped altogether. In my opinion, however, no man ought to be kept in the employ of a railroad company as a fireman who is not capable of making himself an engineer after a sufficient lapse of time.

I also at the commencement of the fireman's fourth year, when he becomes a candidate for an engineer, and before his going into the shops, invariably insist that he should give a pledge of "total abstinence" from all intoxicating drinks while in the company's service.

If at the end of the candidate's fourth year he has conducted himself properly and given sufficient evidence of his knowledge of the construction of the locomotive engine and the principles of its management to make a good engineer, he is promoted to a third-class engineer, with pay \$20 per month less than that of a first-class engineer; but if not found capable he is dropped. After one year's trial as a third-class engineer, if he still gives evidence of capacity and carefulness, he is advanced one grade higher, as a second-class engineer, with pay \$10 per month less than a first-class engineer.

If at the expiration of one year as a second-class engineer he is qualified in every way for a first-class engineer he is advanced to that grade, with first-class pay; but if not found competent in every particular for a first-class engineer he is considered out of the regular line of promotion. He might be retained as a second or third-class engineer, as his merits might determine.

I have generally found that when firemen have passed through all these grades, with proper instruction and supervision from those having them in charge, they will, as a general rule, turn out good, reliable men. This has been my experience, and I cannot but think this course to be just and equitable both to the new men and company, as it compels the engineer to serve a regular apprenticeship to his business, and at the same time pays him liberally for his services as his knowledge of the business increases.

I have always considered it bad policy when a fireman is promoted to an engineer to give him the full pay of a first-class engineer, as it is neither just to the old engineer nor to the company. We all know young engineers just promoted are more liable to accidents, and in many ways are not worth so much to the company as the old, experienced engineer is; and I have sometimes found that raising their pay at one jump has had a bad effect, as the change is so great they sometimes lose their balance and go astray. But by following out the plan I have adopted, when a man is promoted from a fireman to an engineer, his compensation is raised sufficiently for the duties he has to perform, and he has yet to look forward for further advancement, both in pay and responsibility. By the time he has obtained sufficient knowledge and practice to be promoted to a first-class engineer, he will generally be found reliable, as he has then really served six years apprenticeship at the business.

I consider the year a fireman works in the shop to be of essential benefit to himself and the company. He becomes acquainted with the manner of connecting and disconnecting the machinery of a locomotive engine, learning the use of tools, so that in case of an accident to the engine he might be running hereafter, the knowledge he has acquired will be of essential service in enabling him to repair damages on the road, or getting a disabled locomotive out of the way.

I have also found that locomotive engineers promoted from firemen, as herein described, as a general rule are more reliable than machinists taken from the shops, unless the machinist has had sufficient experience as a fireman to have become perfectly acquainted with the duties of an engineer.

Any man of ordinary capacity that may be selected, when given six years' training as has been my practice, will have acquired sufficient mechanical knowledge of machinery, etc., to enable him to take charge of a locomotive engine and keep it in as good order as any machinist can.

The rates of pay as adopted for young engineers of the second and third classes, as herein stated, were arranged when the regular pay for first-class engineers was rated at \$90.00 per month, and are as follows:

Three years as firemen.....	from \$50 to \$55 per month
One year in shop.....	from 55 to 60 per month
One year as third-class engineer.....	70 per month
One year as second-class engineer.....	80 per month
One year as first-class engineer.....	90 per month

Respectfully yours,
ISAAC DRIPPS,

Mr. HAYES, Illinois Central Railroad—I do not now distinctly recollect whether I answered the questions of that Committee or not. In 1852, when upon the Baltimore & Ohio Railroad, under the direction of Mr. Parker, then General Superintendent, we established a system or a board of examiners to examine engineers, either from the firemen or from the shops, for promotion; and then after the examination, if they passed, we gave them a certificate—a printed certificate—signed by the three members of the board. That system has been carried out in all my transactions in railroad matters ever since, up to the present time. We have that system now in Illinois. We make a fireman, after he has fired from three to five years, apply in his own handwriting to the Chairman of the board, or to the Master Mechanic on the division on which he is employed. After these applications are made in sufficient quantity, the board is called together. The board consists of the Superintendent of Machinery or the Master Mechanic and the Division Superintendent and the Train Master. Each one takes his turn at examining, making about 44 questions. We ask them to describe the valve motion throughout, the meaning of lead and lap, the meaning of the exhaust—what the exhaust means, how the steam gets in and how it gets out, at what point water will boil. I examined a young man the other day and asked him at what point water would boil. He said he didn't know exactly, but he thought about 400 degrees. We find young men that have fired long enough to know all these things that have never given it a thought from the first beginning; consequently we put inquiry into their minds, and frequently turn them back; and if we do, the next time they come up you generally find they answer every question. I have found it to be a good system, and I never yet promoted a young man from the ranks of fireman that I have regretted it. He has generally filled the bill from the beginning to the end, and I generally find them more attentive than those men we take out of the shops. In regard to the gradation of engineers, that is all very well; but when you come down to a lawsuit it doesn't work very well. If anything happens on the road, and the lawyer gets hold of the handle of a second-class engineer, he is going to push that suit against the company all he can. I think you had better have the system of getting the best men you can and promoting them, or letting them run in the yard as switching engineers until you find they are competent, and then give them other service, and let them go out on the road. I think that system followed out works well. We have never failed in a single case. Whenever we have promoted young men of ability they have always proved themselves to be good runners.

Mr. GORMAN, Toledo, Wabash & Western Railway—I agree with Mr. Hayes partly in his statements, so far as firemen are concerned. I don't believe in keeping a man two or three years as a second or third-class engineer. I take him out on the road, and if he is a good, intelligent, smart young man, there is no master mechanic but what will find it out before he has been three years, and whether he has got any vim in him or not. I put him to switching, and if he gives satisfaction I put him on the road, with the understanding that for the privilege he gets and for the expense he may be to the company over an old and experienced man, he will work for six months at \$70 a month. At the end of that time, if he proves himself to be as efficient as any others, he goes on to the road on an equal footing with the rest. He receives first-class pay if he does first-class work. If he does not, I wipe him out. I put the firemen into the engine house for six months to give them the whole detail of the business; let them connect and disconnect, and all that kind of work. That gives them the knowledge they require in case they go on the road, in case of a smash-up. I take pains to teach these young men, and if they have not the ability to learn I send them back to fire. Then in regard to machinists, Mr. Hayes' remarks struck me unfavorably. So far as I am concerned, I never fired a day. I have gone and fired a day, or threw in a few sticks of wood, or something of that kind. The first engine I ever got on to was a little English engine weighing about nine tons, and looked to me like a stationary engine on wheels. I just got that idea in my head, and I run that engine the first trip I ever run, with a Buffalo train from Albany to Schenectady. I did so well, and it happened to please them so much, that they gave me that engine to run on a wood train. A machinist ought to have as much intelligence as a fireman. Still I admit it is necessary for him to get the required knowledge by experience if he has not got it naturally. A great many have no knowledge or judgment about starting or stopping or speed. That they must acquire by experience. That is very well, but still I don't like the expression that a machinist will not make as good an engineer as a fireman, because I believe he can if he has got any brains. I believe he can make as good a one if not better. So far as Mr. Hayes' plan is concerned, I like it very well. As regards the examination, I don't believe much in that, from the fact that a fireman, if he gets bluffed the first time and don't know his lesson, will go to an old engineer and learn his lesson. He may not know the first thing about it more than the engineer tells him, but he can repeat it. It will be a kind of parrot lesson; he must learn it and know it, and that can be done only under the observation of the master mechanic. The best engineers I have got I have taken from the firemen and promoted them. I have had engineers come to me with letters that were not to be relied upon at all, that claimed to be old runners. The system of promoting firemen I do endorse and intend to follow it up. I have a great many of them. Besides the apprentice boys I have in the shop, I have a number of them firing intending to make engineers of them; but I do not like the plan of examinations and letters, and all that sort of thing. I think you must judge for yourselves.

Mr. ROBINSON, Great Western Railway—As our plan is a little different from what is adopted in the United States, it will probably not be out of place to say, more particularly than has been mentioned in the report, just exactly our way of raising our engine drivers. It will not take more than two or three minutes to explain it. In regard to selecting mechanics, it is a most extraordinary thing, and I cannot explain it, why a good mechanic does not make the best engine driver. I cannot explain it, but it is a fact that they do not, as a rule. Mr. Brunel, who designed the Great Eastern and who was the Engineer and Master Mechanic in Chief of the Great Western Railway in England, said he always chose for engine drivers men with one idea. He meant that he chose men that knew nothing else but the locomotive, and I have heard that he explained that what he meant by that was this: He thought if a man knew too much about the mechanism of a locomotive, he spent his time in thinking, inventing and dreaming, instead of keeping his eyes on the track, and his mind upon the water and the proper motion of the engine. That seems, although it was so many years ago, to apply now. Our experience amounts to the same thing. On the Great Western Railway the firemen are selected from fitters, helpers and cleaners—from the running shed. They are first of all taken into my office, and there examined to see that they can read and write distinctly and legibly. If they can do that, they are of course asked other questions, to see if they can distinguish colors. If they show ordinary intelligence, they are allowed to go firing on the yard engine. They remain there for three or four years, according to the speed with which we have to promote men, and from that position they are taken and in the next order of promotion put into the running shed in the position of what we call "shed men." In that place their duty is to take care of other drivers' engines during their absence, and see to the raising of steam, and have care of the running shed generally; and in that position they serve one, two or

three years, according to the time required, but always more than one year. That position gives them the main opportunity of becoming acquainted with the steam engine, and all the kinds of engines that may be placed under their charge, and all the different exigencies in regard to locomotives, bringing them in and taking them out, etc. From that position they are selected, according to their ability and merit and long standing in the service, and promoted to switching engines. They are then promoted in due course to engine drivers. Beyond that we make no difference in the pay.

Mr. FLYNN—Mr. Robinson says he cannot account for the fact that machinists do not make as good engineers as old experienced firemen. I think I can, though I myself would prefer the machinist engineers, although, like the rest of the master mechanics, I promote intelligent and deserving firemen. The fault of the machinist is this: knowing every part of the engine as he does, he goes out with the idea that he has nothing to learn. I know that, because it was my experience. I am looking now at the gentleman with whom I went out to learn to run, and although he may forget it I remember it well. I thought I knew something about running an engine, and I undertook to suggest some idea about it, and he said, "Young man, you are here to learn, and not to suggest." The great difficulty with the machinist is, he goes out of the shop believing he has nothing to learn. I have experienced that myself when I have taken young men out to learn to become engineers—men I have thought something of—when I was a locomotive engineer, and endeavored to impress upon their minds that they didn't know how yet to run a locomotive engine, but that with a practice of one, or perhaps two, months, by paying strict attention to what an engineer would tell them, they would make tolerably good runners. I remember one instance on our road, where a young man of extra capacity as a machinist had a desire to learn to be a locomotive engineer, and asked permission of the Master Mechanic to learn. I took him out on the road, pointed out to him several places where it was difficult to stop, and it was necessary to have the train under complete control at the station. I told him, particularly, never to attempt to come in at speed, saying, "You may think you can stop, but you will find you cannot," &c. The upshot of the matter was, after running with me and learning to be an engineer, at one of the stations he ran into trains three times and at another twice, doing more or less damage every time. If we could impress young machinists who desire to learn to be running engineers that they have something to learn that they don't know—that is the management of the train, carrying water, crossing and getting along successfully with the train—they would make successful engineers. I rarely myself take a man out of the shop. My plan is this: If I see an enterprising, intelligent young man, I mark him out for promotion without any intimation to him. I inquire about him and take him and set him to running regular trains. I don't make a switching engineer of him, because I don't consider that a switching engineer can run a train on the line any safer than old firemen. I require four years' service as fireman. Then I send him out and make him an apprentice engineer, requiring that service of him for three years. I pay him the first year a little over one-half of an engineer's pay, the second year about two-thirds, on the third year, full pay; and I must say I have never taken a young man whom I had watched carefully, who kept his engine clean, etc., that has ever disappointed me. Some of the master mechanics present from my section of the country have one or two of my men that I promoted, and they now stand at the head of the road they are running on; one of them in particular, I believe is thought by the Master Mechanic equal to any man on his road. He is quite a young man, having been running an engine eight or ten years. The majority of the promotions to engineers is from the ranks of firemen. That at one time I thought was entirely wrong. I believe it now to be right. I served at the trade myself seven years and four months. I went to it very young. I used to think firemen had no right to be engineers; that it didn't belong to them, but belonged to the machinist. I have learned a different lesson that experience has taught me. Although I regret to say it, I do not exaggerate when I say that in six cases out of ten they make a failure, and the only reason I can give is the great confidence they have in themselves; when they leave the shop to run an engine they think they have nothing to learn; they know it all; they will receive no suggestions from older engineers, and, in my opinion, that explains their failure.

Mr. ROBINSON, Great Western Railway—We do sometimes put fitters out on the road, but never unless they consent to start in the rank of fireman, the same as if they knew nothing; and before a man gets to be driver he has to undergo an examination and answer certain questions which we have set and are liable to alter.

Mr. ELLIOTT, Ohio & Mississippi Railroad—I agree with Mr. Flynn's ideas about the promotion of firemen, but I think it is a very difficult matter to lay down any rule to govern the promotion of firemen. On some roads the promotion is very slow. I have firemen that have been firemen 14 or 15 years, and some 6 or 7 years, and so on, and if it was a rule to promote them whenever they had fired two or three years, they would become dissatisfied. I make it a rule when I hire a fireman to hire him as a fireman; he knows if he shows ability he will have promotion, but I don't consider myself under any obligation whatever to promote him. As between taking engineers from firemen and from machinists, I think the matter is only in the shape of the head. I have known a great many good engineers made from machinists and also from firemen, and that is why we don't like to be bound by any rule. If I find a man that shows ability and is likely to make a good engineer, I keep my eye on him and try him in different places when he don't know my reason for doing so, and if he comes out all right he is promoted, and when he takes a regular train I pay him the same as other men running trains.

Mr. HUDSON, Rogers Locomotive Works—I will add my testimony to the general character of engineers promoted from firemen, as to their being superior and more reliable than those taken from mechanics; but I think at the same time it is desirable to keep as many mechanics and make good engineers of them as we can. One of the reasons is, that most of our master mechanics are recruited from that class of men. We have frequent inquiries for engineers and engine drivers to go out of the country, to South America and elsewhere, and one of the conditions is, they must be mechanics; and we are unable frequently to send a class of men that would make good and reliable engineers because they are not mechanics. I think the class of educated and competent engineer mechanics is diminishing, and I must say I am sorry to see it. While, if I was employed upon a railroad at the present time, I should follow the present practice, from my whole experience as to the better and more reliable character of engineers promoted from firemen, I must say that I regret that mechanics, as a general thing, do not make first-class engineers. I don't know why it is; I do not entirely concur with Mr. Flynn, although to some extent he is possibly right; but, at the same time, when I went first to run a locomotive I thought I could run it as well as the next man. I think if a man with the proper qualifications goes out, with the proper application he will succeed.

The report of the Committee on Printing was received and placed on file.

REPORT OF COMMITTEE ON PRINTING.

To the American Railway Master Mechanics' Association:

GENTLEMEN: Your Committee on Printing appointed at the last annual meeting have attended to the duty assigned them, having had the reports of last annual meeting, circulars, etc.,

printed at the lowest figures given by several responsible printing houses.

Respectfully submitted,

H. M. BRITTON,
N. E. CHAPMAN,
J. H. SETCHEL, } Committee.

On motion of Mr. Elliott, voted that a committee be appointed to draft resolutions, and Messrs. Robinson, Great Western Railway; Clark, Lehigh Valley, and Flynn, Western & Atlantic, were named by the Chair.

REPORT ON SECURING DRIVING AND TRUCK BRASSES.

To the American Railway Master Mechanics' Association.

GENTLEMEN: Your Committee, to whom was referred the question of "Best Method of Securing Driving and Truck Brasses," beg leave to report as follows:

In answer to the Committee's circular of questions, communications have been received from thirty-five master mechanics. Of this number twelve report in favor of half-round driving brasses, six in favor of brass gibs dove-tailed into the driving box, ten for the octagon-shaped brass for driving boxes, five for half-round brasses in three pieces, the top and center piece forming a key to secure them in place, and two for brass gibs with Babbitt metal fitted between the gibs.

On the method of securing the brasses, five report octagon brasses secured by lugs cast in the brass and fitted into corresponding recesses cast in box, one reports octagon secured by plug, one half-round in three pieces secured with pins, five half-round secured with pins, one half-round secured by plug screwed through brass and driving box. Some of the others make no report. All using half-round who have not reported the method of fastening state "they are pressed;" those using gibs the same.

In the use of Babbitt metal, four use gibs with Babbitt, four use the solid octagon with Babbitt, seven use octagon without Babbitt, four use half-round with Babbitt, four use gibs without Babbitt, seven use half-round solid brass without Babbitt, four use half-round in three pieces with Babbitt, and one makes no report on the use of Babbitt. All, with one exception, report that the Babbitt metal should extend the entire length of the journal, and be put in in strips from 1 to 1½ in. wide at a point between the top and front and back points of the journal-bearing; one inserts the Babbitt by drilling holes in the brass and then filling the holes with the metal.

Eighteen master mechanics report using octagon-shaped engine truck brasses, one reports using gibs inserted in cast iron, one a square box, two gibs in cast iron and Babbitt, two report that the shape of engine truck brasses is not important, four use a half-round brass, one a cast iron shell filled with Babbitt metal, and six make no report on engine truck brasses.

Ten report lugs cast in center of brass as means of securing, and eight flanges in to secure octagon-shaped brasses, one uses the square brass flanges, and one reports flanges on half-round brasses, also one reports pins through the gibs to secure them; and these are all the reports made as to means of securing truck brasses.

Twelve reports are made in favor of using Babbitt in the truck brasses. Twelve report they do not use, and do not think it advisable to use Babbitt; and eleven make no report.

The best mileage reported for half-round driving brasses without becoming loose was 120,000 miles; the lowest mileage, 10,000 miles.

The best mileage for octagon-shaped brasses, 125,000 miles; the lowest mileage was 25,000 miles.

The best mileage for brass gibs inserted in cast iron driving boxes was 100,000 miles; the lowest mileage, 75,000 miles.

The best mileage made by brass gibs (three gibs with space between them filled with Babbitt metal), 94,000 miles; the lowest mileage, 71,600 miles.

The best mileage made by driving brasses in three pieces, the top and center piece forming a key to secure them in place, 50,000 miles; the lowest mileage, about one year's run, when they become loose.

The mileage made by truck brasses has not been observed, and no report has been made.

It is almost the general opinion of all that good workmanship in fitting the driving brasses into the box is of the greatest importance; that without good work, brasses of all shapes will become loose and give trouble. The fitting of the truck brasses is not considered important, as no damage can result from their becoming loose.

It has come under the observation of your Committee that brasses (either half-round or gibs) that are forced into the driving box by pressure will almost always spring the box open. As the brass commences to wear at the top, the tendency of the box is to regain the original shape or position previous to the brass being forced in. If the oil collar is fitted tight it prevents its doing so, and the brass will then soon become loose in the box; if the oil collar is a loose fit, as the brass wears the driving box will close at the bottom, and be a loose fit at that point and make a pound which cannot be taken out until the box is planed parallel. This action almost invariably takes place in engines with narrow jaws and light driving boxes with brasses forced in. It can be avoided by making the driving-box casting heavy enough to resist the pressure (necessary to make a tight fit) without springing open. The question then arises, whether the extra weight put in the box could not be applied to a better advantage in some other part of the engine, and a lighter box be devised in which a brass could be secured and desired results be obtained.

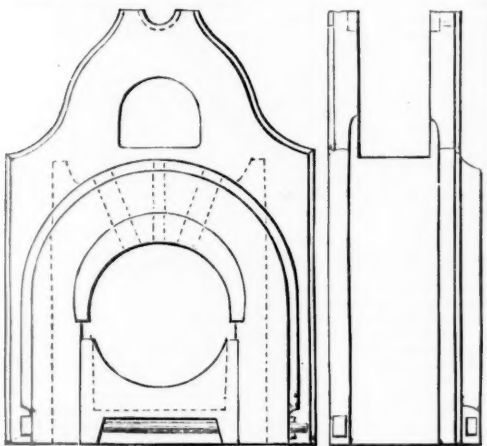
Your Committee has further observed that in engines of from 32 to 35 tons weight the half-round brass does not give as good results as in lighter engines, in the heavy engines rarely making over 42,000 miles without commencing to pound either in the box or brass, while light engines of from 22 to 26 tons will make a mileage of 80,000 miles before giving trouble. This opinion has been formed from a close observation of some fifty locomotives of different weights with half-round boxes.

Your Committee is of the opinion that good results can be obtained from a hexagon-shaped brass, if properly fitted. The expense of doing so is greater than fitting a half-round or gib brass, as the inside of the driving box should be planed out, and the brass planed to fit as near as can be done on the machine, and then carefully scraped until a perfect fit is made. In fitting the brass into the box, the jaws of the box should be slightly sprung open—just enough to let the brass in the box—then allowed to come together with the brass in; then opened, and the brass taken out and scraped where it showed it was wanted, and this operation continued until a perfect fit is made between box and brass, and no trouble will result from their coming loose. The brass will wear until it is cut through into the cast iron. Your Committee have a report of nine engines with hexagon Babbitted brasses fitted in this way, the average mileage being 85,345 miles, and all in perfect condition. One of these engines was examined, to see the condition of the brass, after making 67,000 miles on freight. The brass was perfect, and had worn less than 1/8 of an inch. Another, a 35-ton engine, had made 114,014 miles on heavy and fast passenger trains: brass was worn 1/16 in., but was perfectly tight and in good condition. These engines have been running three years with no repairs on driving boxes or brasses. Your Committee are of the opinion that the recess in the top of the brass is of great advantage, both as a reservoir for oil and, as there is less bearing at that point, the brass wears away and the shaft beds itself into the brass, and there will be no lost motion or pound between the shaft and brass. To secure both driving and truck brasses from working out of the box, your Committee believe that, for half-round and gibs, they are secured best by brass pins driven through holes drilled

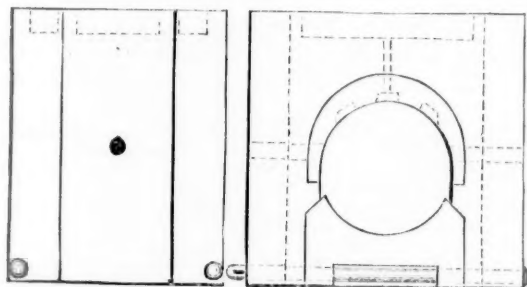
in the box and brass; for octagon, a lug cast on the brass, in center of length, and fitted into recess cast in the box. This is better than a flange on the ends, as the thickness of the brass can be seen without taking it out. There is also danger of the flange wearing off against the wheel or collar on shaft.

There is considerable diversity of opinion as to the utility of using Babbitt metal. Some gentlemen condemn its use, while others recommend it. Your Committee are of the opinion that it is advisable to use it.

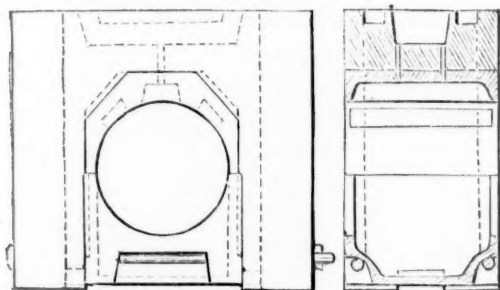
Mr. Wells, of the Jeffersonville, Madison & Indianapolis Railroad, expresses the opinion of your Committee. In his report he says he uses it as a "precaution against cutting: in case the box gets hot the Babbitt metal will run and prevent cutting, unless the box is neglected too long. Does not consider that Babbitt, aside from this, is of any advantage. It will wear longer than brass alone, but will wear the journal more, so what is gained in one is lost in the other." The experience of other gentlemen is the same.



Hannibal & St. Joseph.



Atlantic & Great Western, Broad-gauge Engines.



Pittsburgh, Fort Wayne & Chicago, Western Division.
Weight of box complete, 180 lbs.; weight of brass, 32 lbs.

Herewith please find tracings of the driving box and brass used by Messrs. Towne, of the Hannibal & St. Joseph Railroad, Van Vechten of the Atlantic & Great Western Railroad, Meadville and Boon of the Pittsburgh, Fort Wayne & Chicago Railroad.

Respectfully submitted,
JAMES M. BOON,
Pittsburgh, Fort Wayne & Chicago Railway,
L. S. YOUNG,
Cleveland, Columbus, Cincinnati & Indianapolis Railroad,
GEORGE H. TIER,
Lake Shore & Michigan Southern Railway,
Committee.

DISCUSSION ON BOILER EXPLOSIONS.

Mr. COLEMAN SELLERS.—The experiments that were tried at Sandy Hook were originated by Mr. Francis Stevens and the United Railroads of New Jersey, and the intention was to test various forms of steamboat boilers, and also to try various boilers, new boilers of representative types, as, for instance, flat surface and cylindrical boilers. The boilers they had prepared for these experiments were four large steamboat boilers, very similar to those used on the Westfield. They also had prepared a flat slab, representing the back part of the fire-box of the Westfield boiler—an accurate representation of it—and when the experiments began, in the first place, the first trial was with one of those large boilers that had been tested with hydrostatic pressure up to more than double what the government would allow it to be run at. It was an old boiler that had been in use 15 or 16 years. That was fired up without any safety valve on it. The pressure-pipes were carried off to a safe distance, where those who wished to witness it could do so in comparative safety. Soon after the firing began, the steam ran steadily up until it reached a point, I recollect rightly, of about 56 or 57 lbs.; when it was, I think, at about 57, the boiler showed signs of leaking all over. The principal leak was where the large dome attaches to the boiler. Along there a seam seemed to open, and steam oozed in every direction, and in that condition it continued, showing no diminution of pressure, and gradually the fires went down; and, when we approached, all parts of the boiler were pressed out of shape. The next experiment was upon a flat slab representing a part of the Westfield boiler. This was a slab 5xft. and 4in. thick, stay-bolted in precisely the same manner as the Westfield boiler, and with the same amount of head on the stay-bolts, the same amount of rivet on the stay-bolts. That had been tested with hydrostatic pressure, and also

had been tested with steam pressure, and had no safety valve. It was fired up, and when it reached 125 lbs. we left the boiler and retired to the same distance, and in about five minutes, with 170 or 180 lbs., it exploded. It went out in the form of dishes, each part where the stay-bolt was presenting an indentation like a mattress. As these parts flew out they wounded two or three other boilers. Every stay-bolt was drawn out of its hole. No stay-bolt was injured in the slightest degree on its thread, but every hole in which a stay-bolt was drawn was enlarged sufficiently to allow the stay-bolt and its head to come out, and on the inside of the surface were curious marks, as if it had been in a turning lathe and marked with what is called "lathe work" on the back of the edge. We thought they might indicate lines of strain. On the second day I was not present, but I received accounts of the experiments and remember them. One of those large steamboat boilers was fired up that was considered safe to run at 30 lbs. It had been tested up to 60 lbs. by hydrostatic pressure. It was in thoroughly good condition. They fired it up until it was 35 lbs., and left it. In fifteen minutes from the time they left it the steam ran up until it reached somewhere about 52 lbs., when the whole thing went to pieces with a fearful explosion. The dome was carried 500 feet to one side, and the whole boiler was flattened out and destroyed, representing an almost exactly similar case to the Westfield—the possibility of a boiler having a safety valve so stopped that it could not relieve the pressure, and then being left with only ordinary force for fifteen minutes. I saw the officers of the Pennsylvania Railroad after these experiments, and was very desirous that the experiments should be continued—after the Pennsylvania road had taken charge of the New Jersey road. They told me they didn't think it was worth their while to spend any more money in that direction; that they themselves had already made experiments almost exactly the same as those being tried by Stevens. After diligent inquiry I found that all the documents connected with the experiments on the Pennsylvania road were accessible. They were in the form of letters written to Mr. Cassatt, I think, or Mr. Thomson, I am not sure which; those letters were written, and Mr. Enoch Lewis, the General Purchasing Agent of the Pennsylvania road, in former days General Superintendent, prepared a report from those letters which was published in the *Franklin Institute Journal*. The substance of the experiments can be stated in a very few words: "A locomotive which was condemned, and had been intended to be taken to pieces, was run out on a side track off from Altoona into the woods, and they determined to try an experiment which they had always desired to see tried, namely, the firing of a boiler until the steam was very high, then blowing it out so as to expose the top of the crown sheet and allow it to become red hot, and with a large steam fire-engine force water into that engine. They fired it up and retired to a safe distance. They saw the pressure gauge go up to 125 lbs., if I remember rightly; then the lock-up safety-valve blew off, showing it was not weighted heavily enough. They had no means to determine, except by guess, how much to screw it down, and they did it merely by guess and retired a second time, thinking they could go on with the experiment as they intended; but they had hardly gone from the boiler—they were not five minutes away from the boiler—when the pressure gauge-hand seemed to run round as rapidly as anything could until it reached something near 200 pounds, when the engine blew to atoms. It was full of water, with every condition that would insure safety except that the pressure was a great deal too great for the strength of the material composing it. No other reason could be given for the explosion. They then took a second engine and treated it in the same manner, but that one happened to be strong enough to sustain the pressure they desired. They blew the valve out, and when the glass gauge indicated that it was below the crown sheet, they allowed it to stand long enough for the crown-sheet to be red hot, and pumped water into it; and in pumping this water in, it behaved as I have stated it. The steam merely went down. Once or twice or three times they repeated it. The boiler was injured by the fire, but it did not explode; it nor do any harm to inject large quantities of cold water into the very much overheated boiler. In the experiments at the Harrison Boiler Works with cast-iron boilers, many gentlemen present on that committee of the Franklin Institute were anxious to see this experiment of a red-hot boiler having water suddenly injected into it tried with a cast-iron boiler. They had already fired one of them up to a pressure of 170 lbs. One of those same boilers was fired up to 150 lbs., the blow-off cock was opened and the whole of the steam discharged. We waited then ten minutes and heated the furnace so that a stick of wood put against the boiler would immediately become ignited, and we injected the water in; but instead of making steam, it cooled off the boiler. We waited for steam, blew it off again, and three times we repeated that experiment, and during the whole time I was standing within five feet of that boiler, with my hand on it most of the time, and it behaved just exactly as a mass of iron of that size should have behaved. That is, the water passed into it, merely cooling off the iron, and doing nothing else. The experiment was very interesting, and very conclusive that the whole mass of the boiler, if heated red hot, does not contain heat enough to raise the water the boiler will hold up to the steam point. I think that covers the matters I have to tell you.

Mr. HAYES, Illinois Central Railroad.—I would like to ask Mr. Sellers one question. Have you not a theory of your own on the general cause of the explosion of boilers?
Mr. SELLERS.—I have a theory of my own.
Mr. HAYES.—I would be glad to hear it.
Mr. SELLERS.—My theory is that the pressure in the boiler is too great for the strength of the material. [Great laughter and applause.]
Mr. HUDSON.—I believe that is a matter of fact rather than theory.
Mr. FRY, Grand Trunk Railway.—I feel a little delicate in asking the question, but the expression was so unanimous when Mr. Sellers gave his opinion as to the reason that boilers explode, and there was such a general feeling that he had given the right and true mechanical explanation of it, that I should like to know whether the report as read is to be published in the minutes of this Convention. It seems to indicate, at least I understand it so, that the cause of boiler explosions is something we do not understand, and that in merely looking to superior workmanship and superior material we are looking in the wrong direction. I may have misunderstood the report, but several members understand it the same way. I should like to know whether that is to be published as the opinion of this Convention.

THE PRESIDENT.—All reports received are published in the minutes.
Mr. HUDSON, Rogers Locomotive Works.—I will say, and I think I have said before on this same subject, that it is undoubtedly the great strain that causes these boilers to give way. There is no question about that, and I don't know any way to prevent it except by using the best material we can get, and I think I have said before, putting it together in the best possible manner, and then taking care of it as well as we can. Now while I do not wish to say that there is no such thing as a mysterious and incomprehensible explosion, I do say I have never seen a case where a boiler had exploded, when I had an opportunity of examining it immediately afterward, but I could assign a good and sufficient reason where and why it gave way.

I have never seen anything yet to convince me that there is any decomposition of the water in the boiler that can by any possibility make a gas which can explode or be exploded so as to destroy the boiler. If it is said that the decomposition of the water may take place by the absorption of the oxygen, then we have hydrogen in the boiler, and it is a well known fact that hydrogen gas in equal degrees of temperature exerts a less expansive force than so much steam; therefore, the generation of hydrogen would not increase the expansive force in the boiler, but diminish it. Then for hydrogen to become explosive it wants a quantity of oxygen with which it has just parted into the iron. It appears to me those chemical operations go to work in the easiest way. In other words, they select for themselves the shortest and easiest way of making a combination. I do not think the hydrogen would leave the water and go into the iron, and then back into the water to make an explosion. I do not say that boilers may not be exploded by perhaps an insufficiency of circulation, or by allowing the boiler to stand until the plates become superheated, and throw the water into a spheroidal state. I think that is one cause which may be assigned in some cases; but that boilers explode from any such cause very seldom. I think I have known of one or two cases where I could not assign any other reason. They were not cases, however, that I had an immediate opportunity of examining after the boilers had exploded; but from all the circumstances I could learn, that appeared to me to be the only rational conclusion. I do say the only thing is good material, reliable workmanship, thorough staying, and then good care. I say that is the direction in which to look to prevent boiler explosions.

Mr. PHILBRICK, Maine Central Railroad.—I commenced my experience with a boiler under rather unfavorable circumstances. I was called upon to put up an engine in a small steamboat. I put it together, having a man with me who was to be the engineer. I ran it the first day on an experimental trip. The second day the man suggested, as he was to be the engineer and I had done my work satisfactorily to him, it would be proper for me to let him run the boat that day. I had gone down and put on my overalls as usual, not thinking he was sensitive about it; and when he suggested it, I said, "All right; I never designed to run the boat, and if it is put together satisfactorily I will leave it." I left it, and in about an hour I heard the boat had gone up with the engineer. Then came the coroner's investigation, and we happened to have some men that knew all about engines and thunder and lightning, and a good many other things, and the matter was pressed very hard. It was pressed very hard before the coroner's inquest; so much so that I made some preparations, and went about gathering about a gallon measure of something that was invisible; by plunging hot iron into water and catching the result, I accumulated enough in time to occupy nearly a gallon's space. That I carried to a professor of chemistry who is now President of the Lewiston University, Dr. Loomis. We put a little of it in a glass tube and applied a match to it, and it went off like powder. He said, "You have some gas there, and if I introduce a little more air and mix oxygen with it there will be an explosion of more magnitude." When he let in a little air and applied a match, and there was not any explosion. "Well," said he, "there is not so much gas there as I thought there was;" and by a further and nicer analysis of it, it proved to be a very small portion of hydrogen that had come from the decomposition of the iron and a very much larger portion of atmospheric air that had gone in with the iron into the vessel. He found no indication there of anything that was more troublesome than that; a very small portion of hydrogen obtained by the decomposition of the iron, and nothing else that was more dangerous than that.

Mr. GRANT, Rockford, Rock Island & St. Louis Railroad.—For several months, nearly since January, with the exception of some time I have been sick, I have devoted myself almost exclusively to the subject of steam-boiler explosions. I have perused several works and have consulted with something like 17 or 18 men whom I considered were my superiors, men of intelligence, men that were scientific, and two professors of chemistry. I have become satisfied from consulting with them that there is a gas that is formed in boilers that we know nothing about. I did not get up here to make a speech, because I am no speaker. In fact, I am very timid. Mr. Jauriet has asked Mr. Hay to prepare a paper to be read before this Association. As he is not here, I would ask permission to have it read.

A motion to have the paper referred to read was lost.
Mr. GRANT.—I am sorry this action has been taken. I think it is treating one subject very lightly. I think it is a matter we ought to consider, if we are trying to find out the real cause of boiler explosions. I don't think it will hurt us any to hear it read.

Mr. GREGG, Erie Railway.—I notice by that clock, and I suppose that is Boston time, that it is growing late. We certainly have considerable work to do yet before we close, if we close to-night at all. I hardly think we shall come to any conclusion about boiler explosions, if we stay all night. I will mention simply one case. It is the first I have any recollection of at all—the first locomotive boiler explosion—and that occurred on the Erie road about 32 years ago and created a great excitement at the time, because it was perhaps the first locomotive boiler explosion that occurred in this country. The railroad people appointed several committees to investigate the cause of that explosion, made up of the best scientific men they could find in the country. Among other men employed was Professor Johnson, of Philadelphia. I presume our friend Sellers has some recollection of the circumstances. That committee, after continuing the investigation some considerable time, came to the very grave conclusion (there was a thunder-storm at the time the explosion took place), and I presume that it is on the records of the Franklin Institute, that the locomotive was struck by lightning and that caused the explosion! Now, gentlemen, I say to you here if we stay all night we will not arrive at any better conclusion than Johnson did 32 years ago, when he decided that the boiler was struck by lightning and that caused the explosion. I move that this discussion close.

Mr. GLASS.—I was in the employ of the company when that explosion occurred, and to all practical men it was attributable to cast-iron bars on top of the crown sheet.
The motion was agreed to.

RESOLUTIONS OF THANKS.

Mr. ROBINSON, from the Committee on Resolutions, presented the following, which was adopted:

Resolved, That this Convention do tender their sincere thanks and appreciation to the Bay State Iron Works for the agreeable excursion down the Boston Harbor. To the Committee on Reception, Messrs. Leach and 19 others, for the pleasant drive through the suburbs of the city and their entertainment at the Boston Theatre. To the Rhode Island Locomotive Works, with which we specially mention the courtesies of B. W. Healey, Esq., the Superintendent of the Rhode Island Works, for their liberality in providing an excursion from Providence to Rocky Point. To the Boston & Providence Railroad Company for the facilities rendered to the Convention by providing a train from Boston to Providence and return. To the railways concerned in providing a free passage for the members of the Convention to the Hampshire Hills. Also to the city press of Boston for the kindness extended by them to the Convention in various ways.

FUND FOR PREMIUMS FOR DRAWINGS.

Mr. FORNEY.—The Association during my absence passed a vote remitting my fees. For what reason this was done I am

at a loss to know. I believe the reason attributed was that there had been some imaginary service rendered the Association, which for some reason they conceived they were indebted to me for. I somewhat regret the action taken by the Association, but as it is done I propose to do what I had in contemplation, but what I could not see my way clearly to do, which is to begin a fund to be given as a premium for the best drawing of a machine for removing snow from the track, and another for supplying locomotives with water and fuel. My object in doing this is to encourage the craft, of which I was once a member, that of draughtsmen. I presume all the gentlemen here appreciate how important it is to a shop to have competent draughtsmen. My object is to encourage them and bring here a number of drawings which will also be useful in themselves. I move that a committee of three be appointed to determine at our next meeting which are the best designs for the purposes I have mentioned. I would also like to add, if there are any gentlemen who feel disposed to increase that fund by any additions to it, I hope they will now come forward with their contributions.

Mr. ROBINSON—There are two points in the subjects for our next Convention where there is a sum of money authorized and a dash put there and no sum mentioned. Will it require the action of the Convention or will a committee do?

The PRESIDENT—The Convention has appropriated no money as yet, with the exception of what Mr. Forney has appropriated.

Mr. HUDSON, Rogers Locomotive Works—I will add an equal amount to Mr. Forney's.

Mr. FLYNN, Western & Atlantic—I will give the same amount.*

The motion was agreed to, and Messrs. Forney, Hudson and Sellers appointed.

OFFICERS FOR ENSUING YEAR.

Mr. KEELER, Flint & Pere Marquette Railroad—As it is perfectly competent for the Association to do so, I move that the election of officers be postponed for one year, until the next regular meeting.

The PRESIDENT—I hardly know how to put that question. I don't know whether that is constitutional.

Mr. GREGG, Erie Railway—I think it is perfectly constitutional. The officers have not yet held office for one year, and I don't see how we have any right to elect officers to-night.

The PRESIDENT—The constitution provides,

"The officers shall be elected separately, by ballot, at a regular meeting, and a majority of all votes cast shall be necessary to a choice."

"The officers shall be elected for a term of one year, but in event of the election being postponed shall continue in office until their successors shall be elected."

I will say to the Convention, it was my intention to resign at this meeting, and I so stated in the short address I delivered; but if it is the unanimous wish of this Convention that myself and associates should remain, I will do all that I can for the Association. I will put the motion and will determine then whether or not I will serve.

The motion was unanimously passed.

TABLING REPORT ON BOILER EXPLOSIONS.

Mr. FRY, Grand Trunk Railway—A good many of the members have come to me, and most of them are old members, and requested that I propose we reconsider the acceptance of the report on boiler explosions. The general feeling seems to be that the subject is of vast importance. Our acceptance was passed over before we had discussed it, and before we heard the valuable facts that Mr. Sellers laid before us. We don't undervalue the report, but we feel the subject is of too great importance to be decided hastily, and if we send out an expression of opinion that we do not all, or a large majority, coincide in, we shall assume a false position. I think we ought to make the reports coincide with the opinion of most of the members present, so that the managers of roads may think, in reading these reports, that their master mechanics are arriving at some valuable facts. I think it would be rather unwise to publish mere opinions when we can arrive at some definite facts. I propose to reconsider the motion, and that the report be laid on the table, and no definite report be carried out until we have discussed the matter more fully at other meetings.

The motion to reconsider and to lay on the table were both carried.

MISCELLANEOUS BUSINESS.

The following members were appointed a committee to make arrangements for the next annual meeting at Baltimore: G. W. Perry, Philadelphia, Wilmington & Baltimore Railroad; E. H. Williams, M. Baird & Co.; W. Woodcock, Central Railroad of New Jersey.

Mr. GRANT—Inasmuch as the report of the Committee on Boiler Explosions has been reconsidered and laid on the table, if I am able to be present at our next annual meeting I shall feel as John Quincy Adams did about forty-four years ago on the right of petition. I shall ask the privilege then, if I am in order, of bringing up the subject.

Mr. HAYES, Illinois Central Railroad—I would move that this Convention donate to the Secretary, as his duties have been very arduous, the sum of \$500 for his services. Agreed to.

Mr. ROBINSON, Great Western Railway—In order to make our Conventions a little more pleasant (of course they are now) that each of us try to bring a drawing or model of anything that we have found since the last Convention, or that has occurred to us as new that we think will be interesting and new to some of the members, who may thus have the pleasure and the utility of gaining information upon the subjects to which they refer. They will also be interesting and instructive to any visitors who may come among us. I would also recommend that a committee be appointed to look after these and hang them around the room. You would be astonished how very interesting a convention of this kind can be made. I mention it because it is the practice of similar associations in the old country. It is astonishing to see the number of ladies that come to visit the rooms, besides the dignitaries of the towns—in fact, every kind of person who has any ideas of progress.

The PRESIDENT—I was in hope that you would say you hoped every member would bring a lady with him.

Mr. ROBINSON—I think most of us would enjoy that, too.

Mr. MAYNES, Selma, Rome & Dalton Railroad—Would it not be well to have some limit to the size of these drawings, so they can be filed in a book, or in book form, in which they can be retained among the books of the Association. We cannot frame them and then carry them all over the country to hang them up; but let a size be adopted and they can be kept conveniently.

Mr. ROBINSON, Great Western Railway—It has been suggested to me (and it is a matter between us as the Committee on Resolutions) that one of the most important things of that kind is a resolution of thanks to our worthy Chairman. For my own part, and on the part of a great many others in this

room, I am very sure—at least I say so for myself and I think others will bear me out—I don't think there is a person in the Association who would fill that office so well as our present Chairman. I have been to hundreds of meetings, and I don't think I ever saw so much business done in so little time and in so pleasant and courteous and winning manner as by our Chairman. I propose this resolution:

Resolved, That we tender our Chairman our hearty and sincere thanks for the very kind and courteous manner in which he has led us through the meeting. Also the business-like manner.

I would not forget the last point, for we have done a great deal more than I expected.

The question was put by Mr. Chapman, and passed unanimously.

The PRESIDENT—I don't know what to say. I am happy to know that you are pleased. I don't pretend to deny that I have tried to please you and do the best I could. For my own part I have a pride in that, of course. All that I care for, all that I want to know is, that you are pleased. I will endeavor to serve you while I am your President in the best manner possible, so far as I know.

Mr. HAYES, Illinois Central Railroad—I move we now adjourn to meet in Baltimore the second Tuesday of next May.

The PRESIDENT—Before I put that motion, let me urge upon you all to be particular during the coming year to answer promptly every circular that is sent to you. I will say here, that as soon as the minutes of this meeting can be recorded, they will be notified of their appointment. The men whose names are first on the lists will be the chairmen of the committees, and they are requested to get up their questions and send them to the Secretary to print. He will distribute them from his office. Before I put that motion, allow me to suggest one other thing. There has no Committee on Printing been appointed. Shall the committee of last year be continued?

Mr. HAYES moved that the Committee be continued, which was agreed to.

The PRESIDENT—There is another very important thing that I don't want you to forget; that every member, as soon as he reaches his home, will send his name in full and his post-office address to the Secretary. A letter addressed to J. H. Setchel, Cincinnati, will reach him; also the names of all the foremen under their charge, and the officers of the roads whom they want reports sent to. There has been some little complaint of reports not reaching the members. It is for the want of knowing their addresses. The Secretary has spent a great deal of time in endeavoring to get a correct list of the addresses of the members; but there have been a great many changes on railroads, and he is at a loss to-day to know the addresses of many of the members. We copy a great many from the RAILROAD GAZETTE, which has a very correct list of appointments and resignations. We try in every possible way to keep the addresses correct, but it is a good deal of work, and if members will bear in mind to send their post-office addresses and the name of the road it will facilitate the business very much.

Mr. ROBINSON—Would it not save considerable time if he should send four copies to each master mechanic.

The PRESIDENT—There are some roads that want about ten, and others two or three. We had 1,500 copies printed last year.

Mr. GRANT—I believe the reports, Nos. 1 and 2, are exhausted, are they not? I have heard quite a number of members express a wish to have the first and second numbers of our proceedings. I, for one, would like a copy, and will be willing to share the expense of having them reprinted.

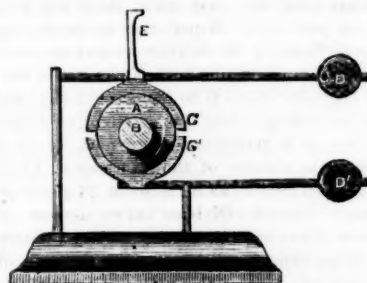
The PRESIDENT—The first report contained but 16 pages, the second about 80 pages, and they are all exhausted. I believe I did recommend on the opening of this Convention that the first and second be reprinted, and the four bound in one volume. Many of the members have bound them in that form, and it makes a very handsome book one that no one need be ashamed to have in his library. If it is the wish of the Convention, they can have it done, or it can be done hereafter.

The motion of Mr. Hayes to adjourn was then carried.

Testing Lubricating Oils.

The following description and diagram of a machine for this purpose we copy from a letter in the *English Mechanic*:

Messrs. John Bailey & Co. have invented and patented a machine for testing oils or grease, which I have used for two or three years with the greatest success. I have found by experience that many oils possess good lubricating properties the first time of using, but after standing a night they become so viscous or gummy that the lathes or planing machines to which they have been applied have had to be taken to pieces and cleaned before they could be started again. Now, as an oil of this sort not only causes great annoyance, but in the hands of a careless workman is calculated to injure the machines to which it is applied, it becomes a matter of great importance to ascertain the amount of stickiness (to use a familiar term) that the oil has acquired after once using. Messrs. Bailey's machine not only determines the lubricating power on first using, but also the loss of lubricating power or the amount of stickiness on the second using. In the inclosed sketch, A is a friction drum or pulley of



cast-iron, about 3in. diameter, keyed on a shaft B. C and C' are two clips or saddles of brass, each extending nearly half round the circumference of the drum, and pressed to it with a constant pressure by means of the two weighted levers D D'. E is a thermometer fixed on the top saddle or clip C, and serves to indicate the heat caused by the friction of the drum revolving between the two saddles C C'. The method of using is as follows: The shaft B and pulley A are made to revolve at a speed of 1,800 or 2,000 revolutions per minute, the number of revolutions being shown by a counting machine indicating up to one million, but which is not shown on the sketch to avoid complication. It will be evident that this velocity continued several minutes will generate considerable heat, and that this heat is raised by a less number of revolutions when a bad oil is used than when an oil of superior lubricating power is used. For instance, if it requires 50 revolutions to raise 1 degree of heat in one oil, and 100 revolutions in another, it is evident that the quality of the first will only be half as good as the second. Before starting the machine the temperature at which the thermometer stands is noted; this, of course, will be the temperature of the room or workshop. A portion of the oil or grease to be tested is poured or smeared on the friction pulley, and the saddles, with their weighted levers, allowed to

press on the drum. The machine is then started and allowed to run till the thermometer indicates a temperature of 200 degrees Fahr. When it is stopped, and the number of revolutions it has made is taken from the "counter," then the number of revolutions divided by the number of degrees of heat that the thermometer has been raised will show its lubricating power. After the first trial the machine is allowed to rest twenty-four hours, and then it is started again without adding any more oil, and without breaking the contact of the saddles with the drum. The number of revolutions of the drum is again taken, and divided by the number of degrees of heat raised in this second trial, and if the result is not more than from 10 to 20 per cent. less than the first trial the oil may be considered good. In very bad oils the saddles are found to be so fast glued to the drum that the machine cannot be started a second time, and in some cases it requires considerable force to break the contact or adhesion between the drum and the brass saddles.

The National Railway.

The following account of the history, condition and purposes of this company we take from the *Philadelphia Inquirer*:

The National Railway Company, in regard to which a number of articles have from time to time been published, has now commenced the work of building in earnest. Workmen are now strung along the entire distance from Bound Brook, where it is to intersect the New Jersey Central, to the Delaware River, and then on the Pennsylvania side to Philadelphia. The contractors—A. Driesbach & Co., of New Jersey, and McGrann & Co., of this State—are pushing forward matters as rapidly as possible, and fifty sub-contractors are at work on various sections, bound under heavy penalties to have the distance between Bound Brook and Philadelphia completed in one year from this time. The surveys are being pushed forward rapidly by I. B. Culver, Chief Engineer.

The privileges of this corporation have been obtained link by link, until at present they form a strong chain, and it may not be uninteresting at this time to republish a history which has been already, in various forms, laid before the public. The legislative history of the road is as follows:

By an act entitled an act to incorporate the Millstone & Trenton Railroad Company, approved April 3, 1867, that company was authorized to build a railroad, with one or more tracks, from some point at or near Millstone, in the county of Somerset, through or near the villages of Plainville, Hopewell and Pennington, to a point at or near the city of Trenton, with other liberal powers.

Another act to incorporate the Peapack & Plainfield Railroad Company, approved March 30, 1865, gave that company the right to lay out and construct a railroad from some place at or near Peapack through the counties of Somerset and Essex, passing within two miles of Liberty Corner, to some suitable point at or near Plainfield; and a supplement, approved March 11, 1864, gave it the right to construct a railroad from some place near Peapack, through the counties of Somerset and Union, to some suitable place at or near Scotch Plains or Plainfield.

An act to incorporate the Elizabeth & New Providence Railroad Company conferred the right to construct and operate a railroad from some point in the city of Elizabeth to some point in the township of New Providence, in the county of Union.

Last, not least, an act to incorporate the New Jersey Trust Company, approved April 16, 1868, gives the right to "build warehouses" on the Hudson River or New York Bay, etc. And by a supplement passed April 16, 1868, and most ingeniously and artfully worded, the said company is authorized "to construct, maintain and operate a railway from its said warehouses to the railroad now operated by the Erie Railway Company, or any other railroad running through, or which shall have its terminus in the county of Hudson."

The same section absorbs into this corporation all the powers, rights and privileges for railroad purposes conferred upon the Mount Hope Mineral Railroad Company, approved March 16, 1866. This of itself very clearly gives the right of the company to build a railroad from any point on the Hudson River to any railroad having its terminus in or running through the county of Hudson. The New Jersey Central Railroad does run through and has its terminus in Hudson County. The right, therefore, very clearly exists to construct a road from Hudson River or bay to any point on the New Jersey Central Railroad. Bound Brook, on the line of the Central, is the objective point now aimed at.

Further assistance was rendered the enterprise by an act to authorize the construction of narrow-gauge railways, approved March 22, 1871—most liberal in its provisions, and having among its incorporators such well-known names as William Beil and Cortland Parker—gives the right to construct and operate one or more narrow-gauge railways, with single, double, or any number of tracks, from the tidewater of Arthur Kill, on Staten Island Sound, to connect with the New Jersey Railroad and Transportation Company, or the Central Railroad of New Jersey, or any other railroad now constructed or hereafter to be constructed, with a right to construct one or more branches. The company was restricted, however, from building a bridge across the Raritan River, or from laying its tracks in the counties of Monmouth, Ocean or Burlington.

The Stanhope Railroad charter granted the power of merging all those separate corporations under one head, and that head is the National Railway Company.

The company has its main office on South Fourth street, below Walnut, and the place is daily assuming a more active business appearance. In New York it has purchased a fine building at No. 96 Liberty street, which is being rapidly fitted up for the company's office for the New York terminus.

MISCELLANEOUS.

—The *Detroit Tribune* has the following, which looks as if it were one side of a story only:

"An order has recently been issued from the headquarters of the Pullman Palace Car Company, which requires each conductor to make a deposit of \$100 with the company to protect the latter against loss. The order is to go into effect August 1, and on that day each conductor will have to make the deposit or, it is supposed, throw up his position. For the purpose of investigating cases of alleged pilferage, the company employs detectives, and the agreement which the conductors are required to sign further provides that the report of a detective shall be deemed conclusive in any case, and that without further proof or ceremony the company have the right to retain the whole of the \$100 deposited. If the conductor leaves the employ of the company for any other cause than dishonesty, carelessness or neglect, the deposit is to be refunded. The new order has naturally occasioned great dissatisfaction among the conductors, and they are protesting earnestly against its being carried into effect, as they claim that it places them at the mercy of detectives and their employers. Many say that they will leave the service sooner than submit to it."

* The following gentlemen subscribed to this fund the sum opposite their names:

Mr. W. A. Robinson, Great Western of Canada	\$10 00
Mr. Gordon H. Notch, Consulting Engineer, Boston	10 00
Mr. R. C. Blake, Manufacturer of Steam Gauges, Cincinnati	10 00
Mr. W. M. Snow, Ramapo Wheel Works	10 00
Mr. Wm. B. Bement, Philadelphia	10 00
Mr. I. A. Williams, Manufacturer of Head-lights, Utica, N.Y.	10 00
Mr. Coleman Sellers, of Wm. Sellers & Co., Philadelphia	10 00
Mr. F. B. Miles, of Ferris & Miles, Philadelphia	20 00

Persons disposed to add to this fund can send their contributions to the originator of it, at the office of the RAILROAD GAZETTE.



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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, except in the advertising columns. We give in our editorial columns our own opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE CHICAGO & NORTHWESTERN.

This is the last of the Chicago railroads to report, and as its earnings have not been given for many months, and its system is the most extensive of any entering Chicago, the records of its operations are regarded with great interest. Occupying, as it does, the entire territory north of the latitude of Chicago and west of Lake Michigan, its prosperity is a pretty good index to that of the country on its lines—Northern Illinois, Wisconsin, Minnesota and Central Iowa. Its traffic is quite distinct in its nature from that of the other railroads entering Chicago. Its southern line (Chicago *via* Clinton to Council Bluffs) may be called the border line between the wheat-growing and the corn-growing districts of the Northwest. Not that corn is not grown in the country further north and wheat (a great deal, too,) in the country further south. But corn and stock fed with corn form a small proportion of the northern district's exports; while in the southern, though wheat is an important product, it is inferior in importance to corn. The other Chicago roads carry corn, stock and wheat; the Northwestern carries wheat. The best country for growing spring wheat is on its lines, and growing stock and corn is generally less profitable there than further south and than wheat-growing.

The story the Northwestern has to tell this year is very much like that of the other Chicago railroads—a decrease in receipts even with a considerable increase of mileage. With the Northwestern, however, this is no new story. Its earnings reached the maximum in 1868-69, the year of the completion of the Pacific railroads, when they were nearly fourteen millions. This was exceptional, being immensely swollen by carrying material for the Union Pacific, which then had no other connection, and, it is said, paid the Northwestern about a million and a quarter in that single year. Since that time there has been a decrease in receipts every year, the falling off being \$1,400,000 in 1869-70, \$350,000 in 1870-71, and for the last year nearly \$300,000, the mileage meanwhile having increased from 1,156 to 1,353 miles. The earnings for last year are less than for any since 1866-67, when the Iowa Division was incomplete. The profits, however, show no such decrease, there having been recently a great decrease in the working expenses.

As with all the other Chicago roads, the Chicago fire

had much to do with the decrease in receipts, though not everything. In common with other roads it has suffered by the overbuilding of new roads, especially near its southern line, which have taken some of its traffic and compelled it to accept lower prices for more. Thus we see that the mileage of passengers transported was only about 1½ per cent. less than the previous year, and the amount received per mile was about 1 per cent. less. The tonnage carried one mile was about 8 per cent. greater, but the price received for carrying a ton a mile was 10 per cent. less. The trifling decrease in passenger receipts was little more than the decrease in the passenger traffic; but with a considerable increase in freight traffic there was a small decrease in earnings.

The working expenses, though not so low as last year, are quite as low as could be expected, and, probably, as is safe for the property. They amounted (including taxes and losses by fire) to 59½ per cent., against 54 per cent. the previous year. For the five years previous, beginning with 1865-66, they were 67, 70, 62½, 57 and 64 per cent., respectively. The mileage in operation at the close of the year was 1,353 miles, but the average operated during the year was 1,312½ miles, very nearly. The extensions, not included in the report of the previous year, are: The Menomonee Extension, Fort Howard to Marinette, 49.1 miles; the extension of the Elgin & State Line road, Richmond to Geneva Lake, 11.5 miles; the extension of the Iowa Midland to Anamosa, 36 miles; the Madison Extension, from Madison to Reedsburg, Wis., 52.6 miles; sundry branches to mines of the Peninsula Division, 9.9 miles—a total of 159.1 miles; making an increase of 13½ per cent. in the mileage operated. The increase in the average mileage operated during the year is about 148 miles, and just about the same percentage as above.

Considering this great property in its relations to traffic, we must not forget that it is not a single railroad with branches, but a system of railroads having three distinct termini in Chicago, and bringing traffic to that city (and pretty much all that the city gets) from an entire quadrant. In such an extensive system variations in the traffic must be expected, and we shall understand it better if we consider the lines separately.

To aid us in doing this we have prepared the following tables, which give for the past two years the gross receipts by divisions; the average mileage and earnings per mile of the road for each year; and the working expenses per division, and their proportion to the gross receipts. We think it will bear studying:

GROSS RECEIPTS.		1871.	1872.
Wisconsin Division		\$2,611,678 67	\$3,037,341 31
Galena Division		3,989,262 91	3,591,888 51
Iowa Division		2,879,556 39	2,343,726 10
Madison Division		302,705 01	359,428 65
Peninsula Division		895,512 08	800,614 32
Milwaukee Division		1,148,237 48	1,369,162 55
Total		\$11,891,914 44	\$11,402,161 44
DIVISION MILEAGE AND EARNINGS PER MILE.		1871.	1872.
		Average Mileage.	Average Mileage.
Wisconsin Division		314.6	317.3
Galena Division		263.4	274.9
Iowa Division		373	414.4
Madison Division		67.6	107.2
Peninsula Division		73.8	83.7
Milwaukee Division		85	134.85
WORKING EXPENSES AND PERCENTAGE TO RECEIPTS.		1871.	1872.
		Expenses.	Expenses.
Wisconsin Division		\$1,587,543 60%	\$1,321,349 63%
Galena Division		1,854,603 46%	2,074,935 57%
Iowa Division		1,820,663 63%	1,634,497 70%
Madison Division		145,688 73	244,206 94
Peninsula Division		367,631 43%	373,484 46%
Milwaukee Division		535,779 46%	557,554 40%

It seems from this that while there has been an increase of just about 10 per cent. in the mileage of the Wisconsin Division, the increase in earnings has been 16 per cent., accompanied by a small increase in the proportion of expenses; there is an increase of less than 4 per cent. in the mileage of the Galena Division, a decrease of 10 per cent. in its receipts, accompanied by an absolute increase in the amount of the expenses of 11 per cent., which is equivalent to an increase of 25 per cent. in the percentage; the Iowa Division has an increase of a little more than 10 per cent. in average mileage, a decrease of nearly 20 per cent. in receipts, with a decrease of about 10 per cent. in expenses, the proportion having increased 10 per cent.; the Madison Division was 60 per cent. longer, received 28 per cent. more, and cost about 70 per cent. more to work, the proportion rising from 72 to 94 per cent.; the Peninsula Division was one-seventh longer, took in one-fourteenth less, and cost about 2 per cent. more to work, the proportion having increased from 42½ to 46½ per cent.; the Milwaukee Division, without change in mileage, received nearly 20 per cent. more, cost only about 4 per cent. more to work, and reduced its proportion of working expense from 46½ to 40½ per cent.

But the relative importance of the various lines is best shown by their earnings per mile. These, it will be seen, vary greatly, the Milwaukee Division producing the very large amount of \$16,100 per mile—exceeded west of Chicago only by the main line of the Chicago, Burlington & Quincy, and equaled, we think, by no other; and the

Madison Division (much of it just opened and all suffering by a general failure of crops) returning only \$2,420 per mile.

But to get at the comparative profitability of the several lines, let us compare their net earnings per mile. These we will find much more uneven than their receipts. They are as follows:

Wisconsin Division	\$3,213
Galena	5,520
Iowa	1,696
Madison	145
Peninsula	5,102
Milwaukee	9,625

The average for the system being \$3,497 per mile.

Very notable are the very large receipts of the line between Milwaukee and Chicago, and still more its astonishingly low proportion of expenses to receipts—the lowest we remember to have seen reported by any American line, and lower than the average in England even some years ago, when all labor and materials were very much lower than they are here now. This is accounted for, partly, at least, by the fact that this road's chief traffic is in passengers, whose transportation in large numbers is generally very profitable. This line, too, commands all the traffic between the two great grain ports of the lakes, on pretty much its own terms, the lake being scarcely a competitor for anything the railroads will touch. This independent position will soon be lost doubtless, as the Milwaukee & St. Paul has its parallel line well under way. The Galena Division is seen to be very profitable, but not much more so than the Peninsula Division, with \$3,500 less receipts per mile, and a road which for some months in the winter has scarcely any traffic. A very compact, easily managed and cheaply conducted traffic the Lake Superior iron ore gives it, and one, too, at present prices, likely to grow very fast.

The Iowa Division, it is seen, fails to earn net its rental of \$856,600, the net earnings having been only \$491,500. These rentals, by the way, are still excessive, notwithstanding the reduction made a year or two ago. While it is probable that the traffic on this line can be conducted for 62½ per cent. when the country is fairly developed, and perhaps very soon; and though it is almost certain that the gross earnings will in time be very large—probably ten or twelve thousand dollars a mile—still 62½ per cent. (on part of the line the rental is only 83½ per cent.) is too near the average expenses of American roads to leave a fair margin for profit, especially in these days of high prices going higher. Doubtless, however, the traffic contributed to the Galena Division has fully made up for any deficit in its own earnings.

We have taken so much space to consider the results of the operation of this system of roads that we have left scarcely any to consider the development of the system itself. We can only say that the plans formed two years ago are being executed. The company's connections with its lines in Minnesota and the Upper Peninsula of Michigan approach completion, and by the time these connections are made the company will have a line entirely across the State of Minnesota to the Dakota border. The new lines are not only wisely planned, but seem quite indispensable to the completion of the system and the proper utilization of the sections now isolated.

THE MASTER MECHANICS' ASSOCIATION—NEXT YEAR.

As we publish in this number of the GAZETTE the concluding portion of the reports of the last Convention of the Master Mechanics' Association, it is perhaps not too soon to look forward to next year, and to begin to lay out the work which, if it have much value, must be done before that next convention is held. A glance at the list of subjects proposed for discussion will show that the work laid out involves many problems whose solution will require much long and patient labor, and, moreover, considerable "scientific use of the imagination."

The subjects proposed for discussion and the committees appointed to report on them were published in the GAZETTE of last week. The first of these—Locomotive Boiler Construction—will doubtless attract as much attention as any other, or more. The discussion on the report submitted this year has excited an interest in the subject and will also indicate to the Committee the direction their inquiries should take. The chief points of difference which existed in the minds of those who took part in the discussion seemed to be the following: First, it was denied that any material deterioration results from punching boiler plates, if the punch and dies are in good order; second, it was asserted that even if boiler seams made of punched plates are 30 per cent. weaker than if they are drilled, nevertheless when boilers explode they do not tear apart through the rivet holes. Even if the first statement be true, it is hardly a question which concerns the Committee, if they can show that plates are injured by punches and dies which are in the condition in which such tools are ordinarily used; for if it requires extraordinary care to keep

them in good condition, then there always will be danger that plates will be injured by punching, whereas with drilled plates there is no such danger. When human life is concerned, as it is with the question of the strength of boilers, we have no right to assume risks, especially such as can be so little guarded against as careless workmanship in boiler making, which cannot be detected and in which we are entirely at the mercy of the faithfulness of the workmen, which, as all who have had experience know, is an extremely uncertain element. Nevertheless it is desirable to know the relative effect of a well made sharp punch, and of one which is worn out or badly made, and the Committee could hardly do better than to make some experiments to determine this point. With reference to the second objection which has been made to the conclusions of the Committee of last year, it is simply a question of fact: Do boilers when they explode tear through the rivet holes? If the Committee would address a question to this point in their circular asking master mechanics to give the results of their observations, it would doubtless call out an amount of testimony which would be quite conclusive. Let the Committee be careful, too, to ask not only for the opinions of the parties addressed, but request them to describe as accurately as they can how the exploded boilers which have come under their observations were torn apart.

There is another direction, too, which their inquiries should take, and to which we have referred before. We mean boiler braces and stays. That these parts are often lamentably and cruelly defective and misproportioned, is obvious to a very casual examination. We recall now an explosion of a locomotive which was caused by the breaking of the braces which tied the boiler shell at the point where the opening was cut into it for the dome. This was very large, so as to weaken the boiler very much. To strengthen it pieces of angle iron were riveted to the dome near the base, and flat bars placed on top with a single hole drilled through them and the angle iron at each end, and bolted to the latter with a $\frac{1}{2}$ inch bolt. These braces were torn loose from their fastenings (?), and the boiler exploded and killed the locomotive runner. That it was little better than manslaughter, all who have any knowledge of the strength of such an attachment must admit. Nevertheless, there are many braces in boilers but little stronger in their fastenings than that we have described, and on them the lives of those who run the engines hang daily as by a thread. Now if the Committee will make some careful experiments with the fastenings for boiler braces taken from locomotives in actual use, and record the experiments with an accurate drawing of the brace and attachment, they will, we believe, be surprised themselves at the weakness of some of these, and will call attention to a subject which needs it sadly.

The second subject for consideration is: "The Operation and Management of Locomotive Boilers, including the Purification of Water." Few who have not had some experience in the West can realize the extent of the evil of impure water; and the loss in fuel from this cause is annually very great. As yet no effectual remedy has been proposed, and hardly any mitigation of the evil. The great surprise is, that it has not attracted more attention from chemists and others engaged in kindred occupations. Any invention which would effectually purify the water which must be used for locomotives in those sections would be very valuable, and if protected by a patent would be immensely profitable to the inventor.

It is not easy to indicate the direction which the investigations of the Committee on this subject should take. The extent and nature of the evil is tolerably well known, and what is now wanted is a remedy. Judging from past experience, we are not hopeful that such a remedy will be found, unless the inquiries of those who investigate the subject take an entirely new direction. We are therefore disposed to recommend that a careful and accurate statement of the extent and nature of the evil be prepared and published, and that chemists and other scientific investigators be invited to give it their attention and communicate with the Committee. This would probably lead persons with different habits of thought to examine and experiment upon the subject, and thus bring their special knowledge and skill to bear upon the problem.

The third subject is: "The Comparative Value of Anthracite Coal, Bituminous Coal and Wood, for Generating Steam in Locomotives." This subject was introduced by one of the Southern members, who said he was in doubt whether it would be cheaper for him to burn coal or wood, and he was unable to determine their relative efficiency for generating steam. Owing to the great difference in the qualities of both coal and wood, it will be hard to assign an exact value to each; and therefore it will be desirable to show how the value of any specimen can at any time be determined. Some experiments made by Chief Engineer Isherwood at the Mare Island Navy Yard, California, a report of which is now

being published in the *Journal of the Franklin Institute*, will aid the Committee in their investigations.

The fourth subject is: "The Construction, Operation and Cost of Maintaining Continuous Train-brakes." This title alone indicates the direction which the inquiries of the Committee must necessarily take. As yet we believe no accurate statistics have been published showing the expense of maintaining either the Westinghouse or other continuous train-brakes. While the great success of the Westinghouse brake has brought it deservedly into notice, it should not be forgotten that there are other competitors in the field whose plans are deserving of examination. It is also true that experience has indicated some risks to which a train is exposed if entire dependence is placed upon what are called automatic brakes. Some of these were discussed at the last meeting and others will doubtless come to the notice of the Committee. To a very great extent these risks are not due to any mechanical defects of such brakes, but could be remedied by adapting the regulations of the road and the running of trains to the new conditions imposed by the use of such brakes. Take as an example the danger of having the rear part of a train run into the forward part if the couplings break. This could be obviated by changing the signal for stopping, from one to two pulls, or perhaps, better still, by devising a signal-bell for the engine which would give a different sound if the cord is broken from that produced if it is pulled by hand.

The Committee appointed to report on "the Relative Cost of Operating Roads of Gauges of 3 ft. 6 in. or less, and those of the Ordinary 4 ft. 8 in. Gauge" have, we believe, the most perplexing of all the subjects, and the one on which it will be most difficult to make a satisfactory report. This difficulty is the result, not of the abstruseness of the subject itself, but of the impossibility of getting any satisfactory data to work from. If they accept the data supplied by the managers of narrow-gauge roads, there will be great danger that the question of the cost of operating light and heavy roads will be confused with that of wide and narrow gauge, two questions entirely distinct and having no mutual dependence on each other.

Next week we will give some consideration to the other subjects proposed.

The St. Louis and Southeastern Railway.

This company merits its name better than before, since the acquisition of the line from Henderson, Ky., to Nashville, Tenn., a short account of which was given last week. To St. Louis "the Southeast" means Kentucky, Tennessee, Alabama, Georgia and the Carolinas, of which Nashville, as railroads are now, may be called the center. And the Southeast to it, more than to more northern cities, is important. It finds there a considerable and a growing market for much Western produce, and a market in which it has to a very small extent the competition of Chicago, Milwaukee and other like cities, all of which compete with it for most eastern traffic. Its chief competitors for Southeastern traffic are Louisville and Cincinnati, both nearer the field (or most of it), and the former well connected with it by railroads. Indeed Louisville's chief business is with the South, and it has comparatively a small traffic in Western produce consumed elsewhere. Of the produce destined for the East from Missouri, Illinois and Indiana, comparatively little stops at Louisville on its way.

But St. Louis has, we may say, three great markets. The East, the great market of the United States, both for consumption and export, where it meets the competition of all the country north of the Ohio; the South, including that part most accessible from the Mississippi River and the railroads as far east as Mobile; and the Southeast, as we have described it above. St. Louis is connected with the latter district as one of its chief purveyors of Western produce—especially flour, corn, hog products, draught animals, and even so bulky a material as hay. The cotton country does not produce its own supplies, and is not likely to, the fact being that it cannot produce corn to advantage, and can scarcely grow wheat and grass at all; and the fatal lack of grass forbids stock raising on any considerable scale, and entails numerous disabilities which it is not necessary to mention here. The mountainous and hilly country of the South, much of which is excellent for grazing, and in the valleys good for corn, hay and small grains, whatever be its capacity, does not, and seems not likely to, fully supply the cotton districts; and there consequently has been, and is likely to be a large demand on the West for the staples consumed in the South.

Moreover, as manufactures increase (and they are increasing rapidly in St. Louis) that city will sometime be able to compete with the East for supplying the Southeast with these, being nearer much of it than is New England and Pennsylvania, and quite as near most of it. The back traffic is comparatively small, the products of the South going eastward chiefly, and, for that matter, being very generally light in weight compared to their value and the area producing them.

St. Louis' connection with the Southeast is either by the St. Louis & Iron Mountain road by the way of Columbus, Ky., to Nashville; by way of Louisville to Nashville; or by way of the new St. Louis & Southeastern Railway. It has also a circuitous and precarious connection by way of the Mississippi, Ohio, Tennessee and Cumberland rivers. The route by Louisville is too indirect to be thought of, being no less than 460 miles long. The Iron Mountain route has the great advantage of a uniform gauge and a transfer ferry, so that its loaded cars go directly

through, and there is no breaking bulk; but this line is 377 miles long. The third route, as it now exists, is but 320 miles long, and a short line, probably soon to be completed, will make it only 297 miles long, and with easy grades.

The St. Louis & Southeastern has had in operation for some months its lines in Illinois and Indiana, including a line from St. Louis east by south to Evansville, Ind., 161 miles, with a branch from McLeansboro southeast 42 miles to Shawneetown, Ill. And it has recently opened a branch (for coal traffic) from Belleville northward seven miles to O'Fallon, Ill. It purchased the American Contract Company's lease of the Evansville, Henderson & Nashville Railroad recently, and more lately bought a majority of the shares of that company, both common and preferred. It has also purchased the Edgefield & Kentucky Railroad, extending from Nashville northwest 48 miles to the Kentucky line, near Guthrie, completing the connection to Nashville. This line so secured extends from Henderson, Ky. (10 miles nearly due south of Evansville), south 74 miles to Hopkinsville, and thence southeast 72 miles to Nashville, with a coal branch two miles long, the entire mileage being 148 miles. The Evansville, Henderson & Nashville road is exactly 100 miles long and has a bonded debt of \$1,000,000, or \$10,000 per mile. The Edgefield & Kentucky road has no bonded debt. The entire incumbrance on the new property, therefore, is less than \$7,000 per mile, which is certainly a very light load.

It is now proposed to consolidate the three companies under the name of the St. Louis & Southeastern, and to fully equip the Henderson & Nashville line, which will be known as the Nashville Division. A part of this plan is also to construct ten miles of road between Evansville and Henderson, in order to reduce the length of the Ohio River ferry, and to complete a line, already about half graded, from the Ohio opposite Shawneetown southeast 47 miles to the Evansville, Henderson & Nashville road at Madisonville, 38 miles south of Henderson (known as the Kentucky Division of the St. Louis & Southeastern Railway). This latter will probably be the first work, as by it the sharp angle at Evansville will be cut off, and the distance from St. Louis to Nashville, which is 319 miles by way of Evansville, reduced to 297 miles. The distances from Nashville to Evansville and to Shawneetown will be the same, nearly. Moreover, the grades will be much easier by way of Shawneetown, and a second river outlet will be secured for the coal mined at and near Madisonville, Ky., which is likely to give a considerable traffic northward, in which direction trains south of the Ohio go empty most of the time.

To provide for the new construction (including five miles of coal branches) and equipment, a new issue of bonds at the rate of \$21,000 per mile is to be made, secured by a mortgage on the entire mileage of the consolidated company, with which the present bonds will be retired. The proceeds of this issue (to be made on completed road) will be sufficient to put the entire line in condition for heavy traffic. The lines in Illinois and Indiana are already well equipped, having a locomotive for every five miles of road, and, considering the short time they have been open, they have developed a satisfactory traffic. The coal mines on the line have contributed much toward this, there being a large number of shafts within thirty miles of St. Louis, which, opened since the construction of the road, already give a heavy traffic, and this is as sure to grow as are St. Louis and its industries. Again at Equality, 13 miles from Shawneetown, are mines of a superior quality of coal, which can be made to supply the local demand on this road and the Springfield & Illinois Southeastern as well, while the Ohio River, close at hand, makes the great Southern market accessible. The same may be said of the mines in Kentucky. The market for their coals is limited only by the price, the chief supply of the entire lower Mississippi now coming from Pittsburgh, nearly a thousand miles further off.

Not the least important improvement of the St. Louis & Southeastern will be made by another company, the Louisville, New Albany & St. Louis Air Line, which is constructing and will soon have completed a line from Louisville west to a junction with the Southeastern 76 miles west of St. Louis. This will be much the shortest route between St. Louis & Louisville, and such of its traffic as goes to or from St. Louis will be so much clear gain for the Southeastern. Connections both with this and with the Evansville line may be expected with the new east-and-west roads across Kentucky, which will make the Southeastern a good route for eastern as well as southern traffic.

The newly acquired line is also a section in the shortest route between Chicago and Nashville and points beyond the latter place. Indeed, from Chicago to Hopkinsville the route is quite straight and almost due south, and it would not be easy to make a more direct line between the two cities. The traffic between Chicago and the country south of the Ohio is not very large, but is well worth having, and, with the roads from Chicago to Evansville worked as one line, a considerable traffic might be cultivated which, owing to the directness of the route, it would not be easy to divert.

We see, then, that while the chief office of the St. Louis & Southeastern, especially as a whole, will be to carry traffic between St. Louis and the country southeast of it, it has such connections and is in such circumstances that it can, and is likely to, receive a quite different traffic. The close connection of Southern Illinois with St. Louis assures it a considerable local traffic in both directions; the coal deposits in three widely separated districts on its lines already afford a good traffic, though as yet hardly begun; part of it forms a good route for eastern traffic for St. Louis and the country on the line; and another part forms a section in one of the shortest possible lines between Lake Michigan and the South. It is the combination of different traffics—some perhaps by themselves unimportant—which gives the best results, as they are likely to give loads in all directions and at all seasons; whereas the line dependent on one leading traffic may be crowded at one season and idle most of the time, and burdened in one direction and

loaded in another. The wise manager plans for many sources of traffic, and if he can make his line part of a profitable route from New York to San Francisco and from Chicago to New Orleans, he feels stronger than with one alone, however productive; and then he will not despise an opportunity to make part of a line from Memphis to Buffalo, or from St. Paul to Savannah.

The Logansport, Crawfordsville & Southwestern Railway.

This Indiana railroad was recently completed by the laying of the track on the section from Camden northeast to Logansport, 15 miles. The line extends from Logansport in a general southwestward direction to Terre Haute, Ind., 115 miles, the 23 miles from Rockville to Terre Haute being leased to this company by the Evansville & Crawfordsville Company. The route from Logansport to Camden, 15 miles, is due southwest and is very close to the line of the Toledo, Wabash & Western (nowhere more than two miles distant, we believe). Thence the route is nearly due south across Carroll County to Frankfort, the county seat of Clinton County, about 24 miles, having a considerable district destitute of railroads on each side of it, and thence southwest diagonally across Montgomery and Parke counties to Terre Haute, in the center of Vigo County, crossing the Indianapolis, Cincinnati & Lafayette, the Indianapolis, Bloomington & Western, the Louisville, New Albany & Chicago, and the routes of the Indiana North & South and the Indiana & Illinois Central, the two latter now in progress. It runs counter to the course of most of these lines, being adapted to carry produce traffic northeastward; while the other lines carry northward, eastward or southeastward. It will probably have little competition for traffic from this country to Detroit, Toledo and the lake cities further east, and the opposite traffic. At Logansport the Toledo, Wabash & Western affords it a good eastern outlet; the Detroit, Eel River & Illinois will also be ready to take its traffic when the gap (about 20 miles) is closed between its present western terminus and Logansport. There are also one or two new organizations, in which officers of the Logansport, Crawfordsville & Southwestern are interested, which purpose constructing lines which will connect it with Toledo. It crosses the northern part of what is called the "black coal field," about 20 miles north of Brazil, and mines are now worked on the line. The average population of the six counties on the line is 34,000 each, which is nearly twice as great as the average of the State; and their average wealth is about \$19,000,000 each—nearly 50 per cent. more than the average of the State. The cities at its termini are among the half-dozen largest in the State. Most of the roads which cross it afford shorter routes for New York traffic; but, as said before, it is almost the only line to Lake Erie, and a very favorable one for New England traffic.

Letting Contracts.

We hear a great deal of complaint from engineers at the way contracts are let by county commissioners, boards of aldermen and other guardians of the interests of the public. A recent case at Troy has been cited, and as it is an example, we will call attention to it. On the 1st or 2d of July, an advertisement appeared in the Troy papers, stating that tenders would be received until the 11th for the construction of a bridge in that city. The time from the 1st to the 11th, with the delay which would necessarily intervene, was quite insufficient to enable those disposed to do so to prepare their plan, and estimates, which gave the action of those in charge of the matter very much the appearance of being arranged for the benefit of some favorite. On the 11th, at the meeting of the Board to consider the bids, all who attended were surprised to find that it was determined to keep the whole matter secret, and plans, estimates and all were locked up and no information regarding the matter made public. On the 3d of August the Board decided to whom the contract should be awarded, but at the same time passed a resolution that everything regarding their action should be kept profoundly secret. In other words, the people of Troy, whose money was thus appropriated, are not to know anything about it. The Board who have it in charge refuse to give information regarding the prices for which the unsuccessful parties were willing to do the work, or the kind of bridge they would build for the money. Under these circumstances the people of Troy might with much justice entertain the suspicion that it was to the highest and not the lowest bidder that the contract was let, or that a very poor design was selected instead of a very good one.

In the case of the Elmira bridge letting, to which we referred last week, the greatest possible publicity was given to the subject. Plans, estimates and all were made public, and all who were present spoke in the strongest terms of the impartial and just way in which the whole matter was treated. Many of our best engineers refuse to compete for bridges when the letting of contracts is entrusted to county commissioners, as they know how necessary it often is to bribe some of those who fill such positions in order to secure such contracts. Entire publicity and fairness is absolutely necessary, if such officers wish to escape the shadow of suspicion.

Record of Track Increase.

This number of the GAZETTE has information of the laying of new track as follows: Milwaukee, Lake Shore & Western, from Sheboygan, Wis., southward to the south line of Sheboygan County, 16 miles. Arkansas Central, from Helena, its eastern terminus, westward 15 miles. Logansport, Crawfordsville & Southwestern, completed by the extension from Camden northeast 15 miles to Logansport, Ind. Winona & St. Peter, extended from New Ulm, Minn., westward to a point six miles beyond Cottonwood River, 38 miles. Philadelphia & Erie, three miles of a new track on the south side of the

Susquehanna, between Williamsport and Linden, are completed. (The old track is on the opposite side of the stream, returning to the south bank at the places named.) Baltimore & Ohio—Metropolitan Branch, track laid from Washington, D. C., northwest to Rockville, Md., about 20 miles. The first engine passed over it July 22. Hastings & Dakota, extended from Carver westward to Young America, Minn., 16 miles. Cairo & Vincennes, track laid in three places to the amount of 30 miles—15 more than when last reported. This is a total of 138 miles.

NEW PUBLICATIONS.

The Franklin Institute Journal for August contains a report from the Meteorological Section under the head of "Lightning and Lightning Rods." The argument advanced is that the defective construction of rods, as is usual in practice, makes the rod of more harm than benefit, but when properly constructed it is a perfect protection.

There was damage sustained to buildings and their contents of nearly half a million of dollars in Philadelphia last season, and those buildings had lightning rods attached in the faulty manner pointed out.

The report is written by Mr. David Brooks, a gentleman widely known in this country and Europe as a practical electrician. Extra copies of this paper, which will be of interest to a very large number who do not usually care for scientific articles, can be obtained on application to the Librarian of the Franklin Institute, Philadelphia.

Report of the Chicago & Northwestern Railway Company.

The Chicago & Northwestern Railway Company operated at the close of the fiscal year, May 31, the following lines of railroad:

	Miles.
Wisconsin Division.	393.7
Chicago to Fort Howard	242.2
Fort Howard to Marinette	49.1
Kenosha to Rockford	72.4
Galen Division.	274.9
Chicago to east bank of Mississippi River, opposite Clinton	137.0
*Turner Junction to Freeport	91.0
Elgin to Geneva Lake	44.5
Geneva to St. Charles	2.4
Iowa Division.	425.4
Length of bridge from east bank of Mississippi River to Clinton	1.1
Clinton to Cedar Rapids (Chicago, Iowa & Nebraska Railroad)	81.3
Cedar Rapids to Missouri River, opposite Omaha (Cedar Rapids & Missouri River Railroad)	271.6
Clinton to Lyons (Lyons Branch Railroad)	2.6
Lyons to Anamosa (Iowa Midland Railroad)	68.8
Madison Division.	120.2
Belvidere to Madison	67.6
Madison to Reedsburg	52.6
Peninsula Division.	83.7
Escanaba to Lake Angeline Mine	67.9
Branches and extensions to mines	15.8
Milwaukee Division.	85.0
Chicago to Milwaukee	85.0
Total miles.	1,352.9

The average length operated during the year was about 1,312½ miles.

At the close of the year this system of roads was worked with the following equipment:

Locomotive Engines.—First-class, 216; second-class and switching, 53. Of these, 98 are wood burners and 171 coal burners. Total, 269.

Car Equipment.—First-class passenger cars, 123; business cars, including pay car and directors' and officers' cars, 4; second-class passenger cars, 27; caboose and way cars, 123; baggage, mail and express cars, 76; boarding cars for men, 7; box freight cars, 3,530; platform cars, 960; live-stock cars, 337; dump cars for road work, 25; iron-ore cars, 1,121; pile-driving, wrecking, derrick and paint cars, 10. Total number of all descriptions, 6,343, exclusive of the Winona & Saint Peter Railroad equipment.

This is an equipment of one locomotive to five miles of road, and 4.7 cars to one mile of road.

There is an increase of 159.1 miles of road over the mileage in operation at the beginning of the year; an increase of five locomotives, and a decrease of 117 cars in the equipment.

From the report of the President, John F. Tracy, we take the following, adding some figures from last year's report for the sake of comparison:

The earnings and expenses, which were largely affected by the extraordinary circumstances consequent upon the great fire in Chicago in the month of October, 1871, are summed up in the general result, as follows:

Gross earnings for the year	\$11,402,161 44
Operating expenses (56.68 per cent.)	\$6,463,100 79
Taxes	29,845 67
Total	\$6,698,946 39
To which are added losses, expenses and renewals paid on account of the Chicago fire, and charged to operating account	\$179,479 51
Less amount received for insurance	68,400 00
	\$111,079 51
Balance of earnings	\$1,592,135 54
From which are deducted other charges for the year, viz.:	
For interest on bonded debt	\$1,109,397 91
Less received for interest and exchange	37,403 57
Total	\$1,071,994 34
For rent of leased roads in Iowa	\$56,610 43
For sinking funds	43,120 00

* The report gives this line as 181 miles long, from Chicago to Freeport. There is a double track from Chicago to Turner Junction, 30 miles, but it is properly only one road.

For dividends paid on Chicago & Milwaukee Railway stock 87 00 | \$1,973 811 76 |

Net earnings for the year \$2,618,323 78 |

From this amount two dividends of 3½ per cent. each have been declared on the preferred stock, amounting in all to 1,486,188 64 |

Balance of net income for the year \$1,132,135 14 |

To which should be added the balance standing to credit of income on the 31st of May, 1871 333,559 17 |

Leaving balance to the credit of income account at the close of the year of \$1,465,694 31 |

The sources of revenue were as follows:

	1871.	1872.	Inc. or Dec.
From transportation of passengers	\$3,333,111 03	\$3,260,654 06	\$72,456 97
From transportation of freight	7,700,808 79	7,531,275 09	170,533 70
From transportation of express	237,812 28	232,484 16	5,328 12
From transportation of mails	189,585 36	202,862 17	19,276 81
From miscellaneous sources	233,296 98	178,885 96	54,411 02

Total \$11,694,914 44 | \$11,402,161 44 |

Compared with the previous year, these items show a decrease of \$292,753, or 2.56-100 per cent. of the gross receipts. The extent of the loss occasioned by the stoppage of business, and temporary diversion of traffic from Chicago to other points, during the depression caused by the great fire in that city in October last, cannot be measured by this result. Of the deficit above shown, \$143,966.16 belongs to first week, and \$279,454.49, or nearly the entire amount, to the four weeks immediately subsequent to the fire.

The total decrease in earnings for the first half year, ending November 30, 1871, embracing the period of the Chicago fire, amounted to \$765,562.21; while the earnings of the second half year, ending May 31, 1872, show a gain over the corresponding months of the previous year of \$472,809.21; being an average gain for the six months of nearly \$80,000 per month.

OPERATING EXPENSES.

The cost of operating, while comparing favorably with the expenses of other leading lines of railway, has been affected by the extra amount and price of labor and materials required for temporary accommodations in the city of Chicago, and in expensive renewals and repairs, consequent upon the destruction of property by the fire. Large outlays were also required for the maintenance of the track and rolling stock during a winter of much severity and long duration in the latitude traversed by a large portion of the company's lines. The whole expenses properly pertaining to operating for the year were \$6,463,100.79, or 56.68-100 per cent. of gross earnings, and including taxes and charges to account of fire losses, were \$6,810,025.90, or 59.72-100 per cent.

NET EARNINGS.

The net earnings for the year amounted to \$2,618,323.78, which is equal to 73-10 per cent. on both classes of stock; and with the surplus at the beginning of the year, amounted to \$2,951,882.95, or 82-10 per cent. From these earnings the directors have declared two semi-annual dividends of 3½ per cent. each, on the preferred stock, leaving a balance of \$1,465,694.31 to the credit of income account at the close of the fiscal year.

CAPITAL STOCK.

The amount of capital stock issued during the past year is as follows:

Common Stock:	
For exchange of Beloit & Madison Railroad stock	\$750 00
For dividends on " "	25 00
For conversion of Peninsula bonds	36,000 00
For fractional dividends on stock	150 00
Total	\$36,975 00

Preferred Stock:	
For exchange of Beloit & Madison Railroad stock	\$800 00
For dividends on " "	300 00
For conversion of Peninsula bonds	36,000 00
For fractional dividends on stock	250 00
Total	\$37,350 00

The total amount of capital stock outstanding, including the above, and that held by trustees, as explained in last report, is as follows:

Common stock and fractional scrip	\$14,810,930 40
Preferred stock	21,067,683 42
Total amount	\$35,878,613 82

BONDED DEBT.

The last installment of \$275,000, of ten per cent. equipment bonds, due on the 1st of November, 1871, was paid off at maturity.

The amount of bonds retired during the year was as follows:

Of Peninsula bonds	\$72,000 00
Of Appleton Extension bonds	34,000 00
Of (Green Bay)	11,000 00
Of Beloit & Madison bonds	9,000 00
Of ten per cent. equipment bonds	275,000 00
Total	\$401,000 00

Consolidated bonds have been issued in accordance with the terms of the mortgage, for bonds retired, to the extent of \$126,000, making a total reduction for the year of \$275,000.

The aggregate of funded debt outstanding against the completed lines of the company has been materially reduced by payments and conversion of bonds into stock during the last five years.

By reference to the report of 1867, it will be seen that the funded debt at that date, exclusive of the debts of the Chicago & Milwaukee and the Beloit & Madison companies, amounted to \$16,251,000. The same class of bonded indebtedness now stands at \$12,375,500, being a reduction in the five years of \$3,875,500.

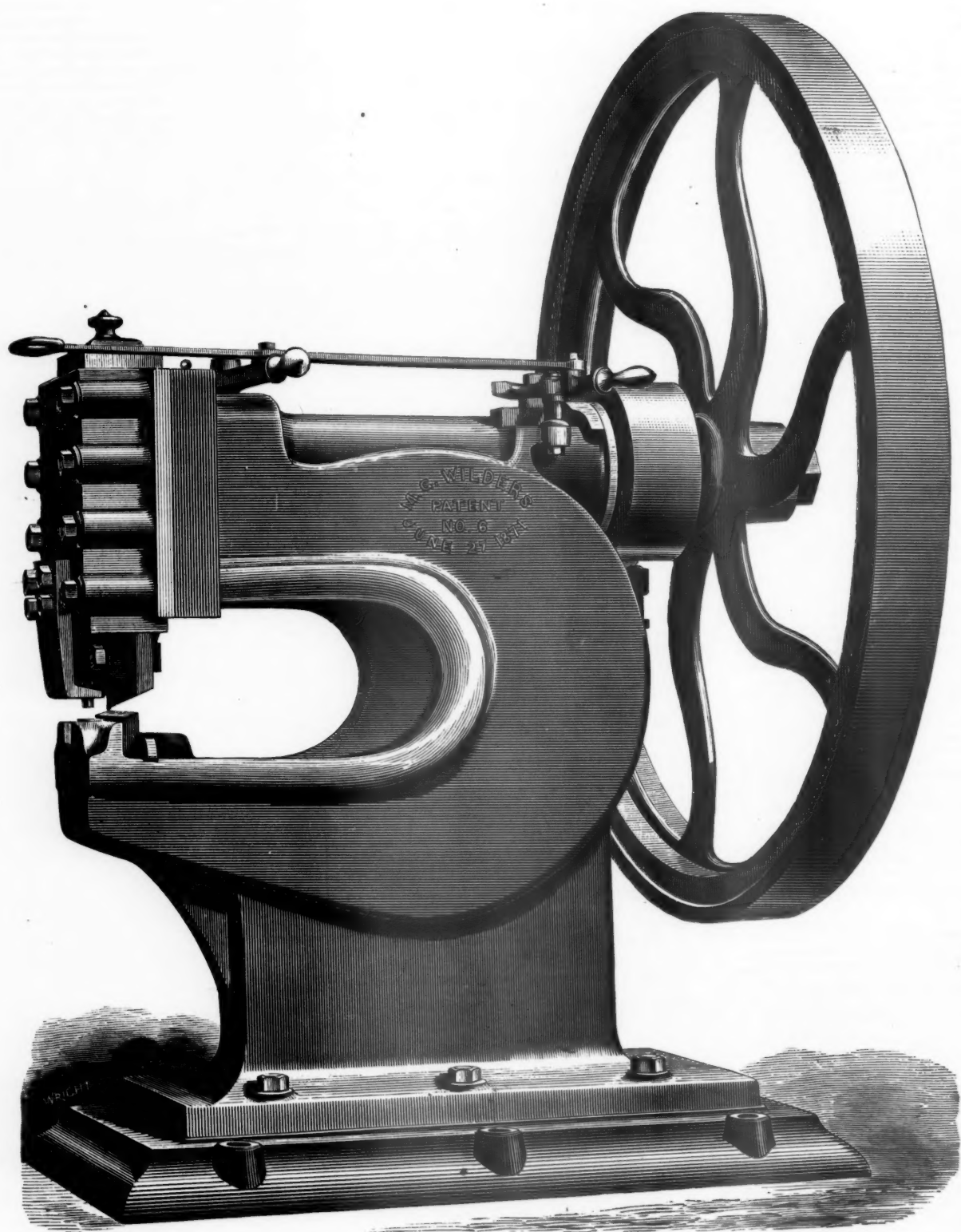
This will more plainly appear in a comparative statement:

	May 31, 1867.	May 31, 1872.	Decrease.
Bonds Outstanding.	\$200 00	None	\$200 00
Flagg Trust bonds	1,250,000	\$1,245,500	4,500
Preferred sinking fund bonds	184,000	148,000	36,000
Appleton Extension	300,000	289,000	11,000
Green Bay	756,000	755,000	1,000
Funded coupon	3,600,000	3,548,000	52,000
General first mortgage	1,919,000	1,785,000	134,000
First mortgage G. & C. U. R. R. bonds	1,173,000	948,000	225,000
Second mortgage G. & C. U. R. R. bonds	189,000	135,000	54,000
G. & C. U. R. R. 6 per cent.	200,000	200,000	None
River Bridge bonds	165,000	101,000	64,000
Seven per cent. equip't bonds	1,075,000	895,000	180,000
Peninsula bonds	2,400,000	2,628,000	228,000
Consolidated sinking fund b'ds	2,900,000	None	2,900,000
Ten per cent. equip't b'ds			
Totals	\$16,251,000	\$12,375,500	\$3,875,500

The amount of Chicago & Milwaukee and Beloit & Madison bonds then outstanding was \$2,097,400. The amount now is \$2,042,500.

Reduction in these bonds \$54,900 |

The more recent issues of gold bonds by this company were



WILDER'S PATENT
COMBINED PUNCHING AND SHEARING MACHINE,
BY THE NEW YORK STEAM ENGINE COMPANY.

made for the purpose of providing means for the construction of the Madison and Menominee extensions, described in the last annual report, and cover entirely new and additional property.

These extensions, when completed, will add about 250 miles of new railroad to our system; and should the expectations which are confidently entertained of their productiveness be realized, they will bring, even at moderate estimates, a large accession of business to existing lines, and greatly increase our annual revenues; sufficient, it is believed, to pay the interest on the bonds and return a reasonable dividend on this new property.

The amount of these bonds, as stated in the general balance sheet appended to this report, is as follows:

For the 126 miles of Madison Extension.....	\$3,150,000
130 " of Menominee Extension.....	2,700,000
Total issue on new works.....	\$5,850,000

The materials are purchased for the track of both these lines, and the grading is being pushed forward to complete them during the present year. Portions of the lines have been opened for use from time to time during the last year, as the work has progressed, and at the date of this report 101 miles have been in operation for a few months to accommodate local business.

The principal object of their construction as parts of the great thoroughfares to the Northwest and North cannot be attained, nor their value as feeders be felt, to any considerable extent, until by completion they shall come to connect with the other portions of our roads which lie beyond them.

CHICAGO FIRE.

The unparalleled calamity which, in the month of October last, swept over a great portion of the city of Chicago, destroyed a large amount of property owned and used by this company, and seriously impaired those facilities which, at their best capacity, were no more than adequate for the accommodation of the usual fall traffic. Among the most important property destroyed were two large brick freight houses, a brick flour warehouse, one large grain elevator, from which the company derived an annual rental of \$25,000, and two other elevators belonging to private parties, situated on our tracks, but which were exclusively used in the company's business. The passenger buildings and depot of the Galena Division, besides several smaller buildings and the large block occupied by the general offices of the company, were utterly destroyed.

One hundred and thirty-three freight cars, standing on the tracks and in the warehouses, were burned. These will be replaced by new cars and the equipment made good.

The total losses were estimated at \$191,000, against which there was partial insurance in good companies. The amount of insurance realized up to the present time is \$68,400. The total loss will probably be something more than the original estimate, and will by a little exceed \$500,000.

The actual value of property destroyed was, however, less than the inevitable loss of business resulting from the first effects of the fire. But the immense recuperative power which inheres in the business of Chicago was too strong for any permanent destruction of trade, and within sixty days after the fire the receipts of the company had recovered their decline, and exceeded the earnings of the same period in the previous year. From that time the increase in earnings has steadily continued, although covering the duldest six months of the fiscal year.

The amount of elevator capacity destroyed was about 1,300,000 bushels, and this curtailment of our storage facilities necessarily restricted the transportation of grain, seeking market over our lines, during the winter and spring. Two new elevators—one on the company's grounds and one on the old site on their tracks—are in process of construction, to be completed, with a capacity of over 1,500,000 bushels, in ample time for the next ensuing harvest. Two large temporary wooden freight houses were erected last fall in place of the brick ones destroyed to supply immediate and pressing wants. Since then and during the winter and spring, the company has rebuilt and is rebuilding the brick freight and flour warehouses, and enlarging others for permanent occupancy. It is not expected that all the buildings destroyed will be restored, but such as are needed from time to time will be rebuilt.

CONSTRUCTION.

During the last year there has been expended on the Madison Extension the sum of \$2,175,007.44, which includes payments for large quantities of iron, ties and materials for the completion of the entire track to the junction with the La Crosse, Trempealeau & Prescott Railroad. The grading is far advanced north of Wauwoc, to which point the track is now laid, and as soon as the tunnels can be finished the whole line will be put in operation.

The sum of \$1,503,560.52 has been expended during the year in the construction of the Menominee Extension, between Fort Howard and Escanaba, and about 50 miles were completed, including the bridge across the Menominee River, and put in operation in February last. The balance of the work is in progress, and will be completed to a connection with the Peninsula Division, by the close of the present year.

Other important expenditures for construction have been made as follows: For new side tracks and extensions to various iron mines in the Peninsula Division, \$122,425.67; for new buildings on the several divisions of the company's line, \$79,575.67; for the Erie Street Viaduct in Chicago, \$23,884.87; for changing the old line of the Madison Division, between Syene and Madison, \$10,608.06; for rights of way and depot grounds, \$11,338.39; for construction of telegraph, \$1,137.17; for the Saint Charles & Batavia branches of the Galena Division, \$2,471.63; and for the difference in weight between the light rails taken up and heavy rails laid down to replace the same, the sum of \$73,663.09; making a total expenditure for these extensions and for general construction purposes, less some items to credit of construction account, of \$3,981,259.01.

Since the last annual report, the Winona & Saint Peter and the La Crosse, Trempealeau & Prescott Railroads have been connected by the completion of the new bridge, with an iron draw, across the Mississippi River at Winona, with its necessary approaches; and the extension of the Winona & Saint Peter Railroad west of St. Peter has been vigorously prosecuted and is now in active progress, with a view of completing the entire line within the period limited by its land grant. The rails, spikes and track materials were purchased in the early part of the year, before the large advance had taken place in the prices of these important and expensive items; and a large saving will be effected by these purchases in the cost of the road.

This line from St. Peter to New Ulm, 30 miles, was opened in February last, and the remaining portions are being rapidly constructed. The cost of this extension and its equipment is borne by the Winona & Saint Peter Railroad Company, and the means provided by the issue of its first-mortgage gold bonds on the property, and further secured by the proceeds which shall result from the sale of its land-grant lands. There has been expended for account of this extension, within the year, the sum of \$2,423,262.51, and the further sum of \$20,317.81 for account of the previous extension east of St. Peter, and for the branch to Mankato.

The Iowa Midland Railway was finished to Anamosa in October last, where a connection is made with the Dubuque & Southwest Railway, with which reciprocal and permanent arrangements have been established that will materially benefit and increase the business of both parties. The expenditures for account of the completion of this road for the year were \$730,883.74.

The opening of the line to Anamosa was made at a period so nearly simultaneous with the occurrence of the Chicago fire as to seriously affect the natural course of its business during the entire fall, and caused a diversion into other channels of a large share of its traffic, which, under ordinary circumstances, would be forwarded over the Galena Division to Chicago.

The General Manager, Mr. James H. Howe, reports the earnings of the several divisions of the road as follows. We have added the figures for 1870-71:

	1871.	1872.
From the Wisconsin Division.....	\$2,611,578 67	\$3,037,341 31
Galena ".....	3,989,369 91	3,591,888 51
Iowa ".....	2,879,556 39	2,343,736 10
Madison ".....	302,705 91	259,428 65
Peninsula ".....	855,573 08	800,614 32
Milwaukee ".....	1,146,237 48	1,369,162 55
	\$11,694,914 44	\$11,408,161 44

The operating expenses were \$6,463,100.72, or 56.68-100 per cent., and the same, including taxes and the expenses incurred by the fire during the year, were \$6,810,925.90, or 59.72-100 per cent.

The increase of earnings upon the Wisconsin Division, over those of the previous year, amounted to \$425,762.64, and is attributable partly to the growth of the country, and the great activity which pervades the northern and central portion of that State, and partly to the opening of the extension of our new line, from Fort Howard to Menominee River, about fifty miles in length, which the company began to operate in February, 1872. This gave access to the lumber regions of Oconto County, and furnished a business, all of which had heretofore been done by lake during the season of navigation. The transportation of lumber from that extension, as well as the extension from Menominee to Escanaba, when completed, is likely to form a constantly-increasing source of revenue to our company. The transportation of this lumber, and the coarse and heavy products of the forest to market, by rail, at a low rate, in competition with water carriage, has, to a small extent, increased the percentage of operating expenses on this division.

The operating expenses were \$1,921,348.90.

On the Galena Division there was a decrease in earnings of \$397,374.40, arising mainly from the failure of the crops for the season of 1872. This division has also been affected by the interruption of through business on the Pacific roads during most of the last winter, and to a small extent by the competition caused by the completion of other railroads into portions of the territory heretofore more directly tributary to this line. The percentage of operating has been increased by the extraordinary expenses of the fire, which, occurring at the local terminus of this line, are charged to this division.

The expenses of the Galena Division were \$2,074,935.25.

The same causes which diminished the receipts of the Galena Division have, to a greater extent, affected the Iowa Division and reduced its earnings. The blockade of the Union Pacific line by snow during many weeks of last winter deprived us of a considerable amount of earnings in common with other Eastern lines. The destruction of our grain elevators by the Chicago fire not only checked the movement of grain, but also caused the diversion of a large amount of traffic from this division during the fall months, and the limited ability of the company to offer storage facilities during the winter and spring has contributed to the decline on this part of the road. Our largest losses have occurred on this division.

Its expenses were \$1,638,496.92.

The business on the Madison Division shows an increase of \$56,722.74, derived from the incomplete extension, which has had only the additional traffic of a few new local stations that were reached by it at the close of the year. The harvest of 1871 along the entire length of this division was almost a total failure. A large sum has been expended in filling up the piling and track in the lake at Madison, for the purpose of making as rapidly as possible a more durable and solid roadway.

The expenses of the Madison Division for operating and improving were \$244,206.13.

The traffic on the Peninsula and Milwaukee divisions has been large and satisfactory. Lower rates were made in some localities for the transportation of iron ore during the past year than had before prevailed, and it was deemed best to re-adjust our tariffs to the decline and encourage the greatest production of ore. A larger tonnage has resulted during the year, and accommodations are now being provided in a second ore dock at Escanaba for the further growth of traffic from new mines, and for the products of the new mineral districts of the Menominee River, which will be opened up to market by the construction of our Menominee extension to Escanaba.

The destruction of so many homes at Chicago, and the dispersion of a large population from the city to the suburban districts, have combined with a large through traffic to increase the business of the Milwaukee Division, and additional and increased accommodations have been afforded to passengers.

The expenses of the Peninsula Division were \$373,484.22.

The expenses of the Milwaukee Division were \$557,554.48.

PASSENGERS AND FREIGHT.

	1872.	1871.
The number of passengers carried during the year was.....	2,334,705	2,229,494
The number carried one mile.....	99,299,476	100,804,221
The earnings per passenger were.....	\$1 47	\$1 49
The average earnings, per passenger, per mile.....	3.38 cents.	3.31 cents.
The number tons freight carried was.....	2,510,016	2,399,170
The number tons freight carried one mile.....	387,764,006	263,417,381
The earnings per ton were.....	\$3 00	\$1 35
The earnings per ton, per mile, were.....	2.61 cents.	2.87 cents.
The total number of passengers and tons of freight was.....	4,734,721	4,537,664
Total of same carried one mile.....	387,063,483	369,219,932
Average earnings per passenger and per ton.....	\$2 38	\$2 43
Average earnings of same per mile.....	2.92 cents.	2.99 cents.

Five new engines and tenders complete, one baggage car, 104 box freight cars, 80 live stock cars, 25 dump cars, 125 iron ore cars, and 5 caboose ore-train cars, have been added to the equipment during the year, and one old passenger car has been sold. The total cost of this new equipment was \$213,950.88.

For the Winona & St. Peter Railroad Company there has been purchased 7 freight engines, and 7 more are contracted for, to be ready for delivery by the 1st of September next. For the same purpose there have been built at the Fond du Lac shop 2 baggage cars, 1 passenger car, 100 box cars, 100 platform cars, and purchased from other builders 315 box cars. This equipment has been provided to meet the demands of the extension of the Winona & St. Peter Railroad, now in process of construction, and will be used in the interchange of business with our company, under the usual mileage arrangement, upon this company's lines, when not needed upon the road of that company.

The General Manager reports that the expenditures for track repairs amounted to \$1,458,516.39, and included the cost of renewing and repairing the rails for 187½ miles of track, which is about one-eighth of the track mileage. Of these, 26,225 rails were repaired or rerolled at the Junction shops (at a cost of about one dollar each); 6,807½ tons (77½ miles) were rerolled iron rails, costing about \$28 per ton in the track; 1,714½ tons (about 17½ miles) were new steel rails, costing about \$116 per

ton in the track; and 2,125½ tons (about 22½ miles) were new iron rails, costing about \$117 per ton in the track. The ties renewed were equivalent to 179 miles. Compared with previous year (when the saving in fuel had already been enormous—about 35 per cent.), the cost of wood was reduced from \$4.60 to \$4.14 per cord, and of coal from \$3.71 to \$3.48 per ton. The average cost of fuel for locomotives per mile run was 10.85 cents against 11.37 the previous year, the mileage per ton or cord having increased from 33.26 to 33.97.

The General Manager also expresses his obligations to the General Superintendent (first John C. Gault and afterward Marvin Hughitt) and division superintendents (A. A. Hobart of the Wisconsin and Milwaukee Divisions, E. J. Cuyler of the Galena Division, John B. Watkins of the Iowa Division, O. Boardslee of the Madison Division, and S. C. Baldwin of the Peninsula Division) "for their valuable co-operation and untiring services in the management of the road;" to the Local Treasurer and General Accountant (M. M. Kirkman), "for the able and faithful supervision of the financial concerns and general accounts of the company at the Home Office," and to the General Freight and Passenger Agents (C. C. Wheeler and H. P. Stanwood), Assistant Secretary (J. B. Redfield), Purchasing Agent (R. W. Hamer), and other heads of departments, "for the efficient services they have rendered in the discharge of their duties."

Wilder's Patent Combined Punch and Shears.

In many shops the great expense of the most improved power punching and shearing machines has prevented their introduction; hence the work is still performed in the slow and tedious manner of years ago, while the cost is greater just in proportion as the method of working is less perfect and rapid. This machine, shown in our illustration, has been designed by the inventor with reference to such cases, and is believed by him to combine all of the necessary qualities of such a machine in a better form than has been previously shown.

The cut shows the machine with a plain fly-wheel of large size, used instead of gears in cases where a somewhat rapid motion is possible. It is made, however, with a geared driving train in any case where a slow motion is best for the work to be done. The machine is arranged to shear half-inch iron plate to the center of a 36-inch sheet of any length, without gears; or to shear ½-in. plate, when made with gears. It will punch holes three-quarters of an inch in diameter in half-inch plate to the center of forty inches in width; or will, when geared, punch three-quarter-inch holes in three-quarter-inch iron of the same width.

The punch is made so that it can be instantly removed from the machine and the shear blade substituted, or vice versa, as may be desired. The cut shows them both in position, but this is never the case when the machine is in use. The die and lower shear blade are both so arranged as not to interfere, when either is not in use, with the use of the other; for this reason it is not necessary to move them except when they require sharpening or the size of hole is to be changed. The stop motion is very strong and certain in its operation, and may be operated from either one of three positions in which the operative would stand in handling the sheet to be sheared or punched.

In a test of the machine recently it cut off a bar of iron one inch thick and two inches wide without gears, and was then, for a test of ability to bear any possible strain, stopped while running at full speed instantaneously by throwing under the punch a piece of iron nearly an inch thick. The fly-wheel, which is five feet in diameter and weighs one thousand pounds, was stopped with a shock, and the five-inch belt which drove it was thrown off; but no injury was done to any part, and when the iron was removed and the belt put on again, it was found to be in perfect condition. The wheel was running 72 revolutions per minute.

In many cases the form of the machine is an advantage, as it can be set back against a wall or partition, and does not require much spare room about it for handling the work; while in the ordinary form of combined punches and shears, the machine must be set nearly in the middle of the floor.

This is one of a series of such machines adapted to all kinds of punching—such as for boiler-makers, car and railroad machine shops, brass, copper, tin and sheet iron workers, etc.—which are being made by the New York Steam Engine Company, No. 121 Chambers street, New York, under these patents. The inventor and designer is known to many of our readers as the agent of this company. He has had a large experience in this kind of work, and these machines are now made under his personal supervision.

The Chicago & Northwestern and the Illinois Central.

The following extracts from the decision of Chief Justice Williams, of the Cook County, Ill., Circuit Court, dissolving the injunction restraining the Illinois Central from refusing to operate its line in connection with the Galena Division of the Northwestern as a through passenger route, contains interesting history as well as important law:

The Galena & Chicago Union Railroad Company was chartered in the year 1836. At the commencement of the year 1851 it had constructed its road to a distance of about 40 miles, commencing at Chicago and extending west to Elgin, and had also surveyed and located its road from Elgin west to Galena and Dunleith. In February of the year last mentioned the Illinois Central Railroad was incorporated, and by the eleventh section of the act of incorporation it was provided that it might connect with any road then being constructed on the line of such road with the consent of the company constructing the same, the said Illinois Central Railroad and the road with which it connects according to each other facilities for the transshipment of freight and passengers, and interchange of cars upon their respective roads upon fair and equitable terms, and in case of disagreement submitting themselves to the decision of arbitrators chosen as in the act specified, whose decision was to be final. In October, 1853, a written agreement was entered into between

the Mineral Point Railroad Company, on the one part, and the Illinois Central and Galena & Chicago Union Railroad Company, of the other part, to continue for the period of 20 years for the purpose of increasing the amount of business to be transacted over the road of the Illinois Central from Warren to Freeport, and over the road of the Galena & Chicago Union Railroad Company, between Freeport and Chicago, and in December of the same year a written agreement was also entered into between the Galena & Chicago Union Railroad Company and the present defendant regulating the mutual operation of their roads, and providing for the terms upon which the roads should be operated together; that in March, 1855, another agreement, or running arrangement, was made between the same companies for their respective lines of road, east and west of Freeport, under which the parties thereto continued to run their roads in connection for several years. That in a short time after the execution of the last-mentioned agreement a considerable sum of money was expended by the Galena & Chicago Union Railroad Company in making connection with the Illinois Central at Freeport, so that the roads of the respective companies could be operated as one line of road from Chicago to Dunleith, according to the terms of the aforesaid agreement, \$10,000 having been paid by the Galena & Chicago Union Railroad Company to the Illinois Central Railroad Company, on account of the costs of such connection, and valuable depot grounds purchased at Freeport by the Galena & Chicago Union Railroad Company, which were used by the Illinois Central for the same purpose. That in 1864 the Galena & Chicago Union Railroad Company was legally consolidated with the Chicago & Northwestern Railroad Company; that difficulties arose between the Chicago & Northwestern Railroad Company and the Illinois Central, in reference to the running arrangement, and many discussions were had in reference to that, and much bad feeling engendered between the two companies, they each charging the other with having failed to carry out their running agreement, until in the year 1869 the Illinois Central ceased to make connection with the freight trains of the Chicago & Northwestern Railroad Company between Freeport and Chicago, but that the road had continued to be run as one line from Chicago to Dunleith for passenger business up to the time of filing the bill of complaint. The defendant having given to complainant notice that it would cease to receive complainant's cars to be transported on defendant's road, and would not, after the 6th of May, 1872, run this road in connection with complainant's road, as a through passenger line, but that they would run their road in connection with other roads by the way of Forreston, as the through line from Chicago to Dunleith, the complainants thereupon filed their bill to prevent such diversion of the passenger business to another road, alleging that in such an event the injury they would sustain would be irreparable.

Having stated the purport of the bill and the facts surrounding the case, upon which the interlocutory order issued, the Court proceeded to decide, in substance. The eleventh section of the legislative act referred to bonded the Illinois Central to afford to the Galena & Chicago Union facilities for the transportation of freight and passengers and in the interchange of cars upon fair and equitable terms; and in case of disagreement between the companies to submit the matters of difference to arbitration. Whatever beyond this was done by way of accommodation was a voluntary act to promote mutual convenience. The defendant, by its charter, is not compelled to run the road in connection with the Galena & Chicago Union as one entire line; but, to the contrary, "transshipment" is spoken of as though to imply or indicate "that both passengers and freight were to be taken from the cars of the Galena & Chicago Union Railroad Company and placed upon the cars upon the road of defendant, and not that they were to proceed upon the defendant's road in the cars of the complainant."

The charter does not provide for facilities for the transshipment of cars, but for the transshipment of the passengers and freight which the cars may contain. If, then, there be a right to compel a continuous line of road it must be under some contract. On the part of complainant it is insisted that for years past this has been the course of business. This may be true, but no present obligation might exist to continue such an arrangement.

But here arose the question as to whether an arrangement made by one Rantoul was binding. If the defendant company had adopted it then, so it would be, but the Court fails to see that the indorsement had been established by the testimony. Whatever arrangement he made failed to impose any permanent obligation to run the two roads as a continuous line; his arrangement lacked fixed duration, unless the law aided it. The Court had already found that the law did not. There was a running arrangement made, but there was no proof that it was for a term fixed, or that it was even reduced to writing. The parties to the suit entered into an agreement in December, 1853, for the operation of their roads, and the defendant had a right to terminate this agreement upon the opening of its road to Dubuque, with option to continue its arrangement with the Galena & Chicago Union, which was to operate its road until the Illinois Central from Freeport to La Salle was opened for use. George B. McClellan states that in April, 1859, he was authorized to abrogate the memorandum of March, 1855, which he supposed he had done, he agreeing to a temporary arrangement. This abrogation complainant had denied. The Court concluded that neither the defendant's charter, nor any agreement it had made, gives to the complainant the right to compel defendant to operate its roads in connection with the road of complainant as a through passenger line, without change of cars, between Chicago and Dunleith; but that the only obligation now resting upon defendant is that imposed by the eleventh section of its charter, which is merely that it shall afford all proper facilities to the complainant: "in the transshipment of freight and passengers, and interchange of cars over the respective roads. I shall dissolve the injunction now subsisting against the defendant."

PERSONAL.

—Mr. John F. Tracy, President of the Chicago & Northwestern and Chicago, Rock Island & Pacific companies, returned from Europe, where he has been for a year past, last week.

—Mr. P. A. Hall has resigned his position as Assistant General Superintendent of the Chicago, Rock Island & Pacific Railroad. Mr. Hall has operated Chicago railroads longer, probably, than any other man, having been Superintendent or Assistant Superintendent of the old Galena & Chicago Union road in its early years, and, we believe, when there was no other railroad in Chicago.

—Mr. B. W. Blanchard has resigned his position as General Freight Agent of the Erie Railway, which he had held for many years.

—The earnings of the St. Louis and Iron Mountain Railroad for the third week of July were: 1872, \$43,630; 1871, \$32,329.05; increase, \$11,300.95, or 35 per cent.

—The earnings of the Kansas Pacific Railway for the third week in July were: For passengers, \$29,364.95; freight, \$32,831.45; mails, \$1,400; total, \$63,596.40. Of this amount \$1,893.64 was for transportation of troops and government freight.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—Luther Allen has resigned the position of Traveling Auditor of the Lake Shore & Michigan Southern Railway, to accept the position of Auditor of the Northern Pacific Railroad, and Mr. A. C. Smith, late Cashier at Toledo Station, is appointed Traveling Auditor.

—Thomas R. Sharp has been appointed Superintendent of the New Jersey Southern Railroad, in place of William G. Peck, with headquarters at Long Branch.

—At the annual meeting of the stockholders of the Atlanta & West Point Railroad Company, held at Atlanta July 25, John P. King, Richard Peters, William B. Berry, Ferdinand Phinizy, John E. Robinson, John F. Moreland and L. B. Lovelace were elected directors. At a subsequent meeting of the board of directors, John P. King was elected President; W. P. Orme, Secretary and Treasurer, and L. P. Grant recommended for Superintendent. The above are all re-elections.

—Mr. A. J. Binny has resigned his position on the North Pacific Central Railroad and gone to Marysville as Superintendent of the Northern California road.

—At a meeting of the stockholders of the Carbondale & Shawneetown Railroad Company, 2,580 shares were represented and the following board of directors was elected: Samuel Dunaway, John Goodall and M. C. Campbell, Marion, Ill.; W. P. Hanchett, Carbondale, Ill.; W. P. Cutler, Marietta, Ohio; E. C. Dawes and R. H. Fleming, Cincinnati. The board of directors subsequently chose S. Dunaway, President; E. C. Dawes, Vice-President and Managing Director; W. B. Stephenson, of Cincinnati, Secretary; R. H. Fleming, Treasurer; and W. P. Hanchett, General Superintendent. Messrs. Dawes and Cutler are largely interested in the Chester & Tamaroa, and are also among the incorporators of the projected Chester & Iron Mountain Company. They are also directors of the Springfield & Illinois Southeastern, and the Logansport, Crawfordsville & Southwestern.

—Mr. J. F. Barnard having resigned his position as Chief Engineer and General Superintendent of the St. Joseph & Denver City Railroad, Mr. W. H. Sheridan has been appointed General Superintendent and Mr. E. Whiting Chief Engineer. The Superintendent takes charge of the ticket and freight business, the office of General Freight and Ticket Agent having been abolished temporarily.

—G. G. Sanborn, formerly General Ticket Agent of the New Orleans, Mobile & Texas Railroad, has been appointed General Ticket Agent of the Northern Pacific, with headquarters at Brainard, Minn.

—Samuel Carpenter has been appointed General Eastern Passenger Agent of the Pennsylvania Railroad, to succeed the late John H. Miller. Mr. Carpenter has been many years in the service of the company, and for a few years past has been General Baggage Agent.

—Mr. J. W. Watson is appointed Train Dispatcher for the Western Division of the Lake Shore & Michigan Southern Railway, from August 1, 1872, with his office at Elkhart, Indiana. Mr. Watson was Train Dispatcher on Buffalo Division. He succeeds J. H. Hatch, who goes to the Kalamazoo Division as Train Dispatcher.

—Captain W. Harrison, late Master Mechanic in the Cumberland shops of the Baltimore & Ohio road, has been appointed Master Mechanic of the Pittsburgh, Washington & Baltimore road, with headquarters at Connelville. He will also have charge of the Hempfield road.

—Mr. A. Kimball, Superintendent of the Eastern Iowa Division of the Chicago, Rock Island & Pacific Railroad, was appointed, August 1, Assistant General Superintendent, to succeed Mr. P. A. Hall, resigned. For the present Mr. Kimball's office will remain in Davenport.

—Mr. Allen Manvel, Purchasing Agent of the Chicago, Rock Island & Pacific Railroad, is appointed Superintendent of the Illinois Division and Bureau Valley road, heretofore under the charge of Assistant General Superintendent Hall. Mr. Manvel will retain charge of the purchasing department until further orders.

—Mr. James Breckenridge, late a passenger conductor on the Rockford, Rock Island & St. Louis road, has, it is reported, been appointed General Roadmaster of the line.

—Mr. W. B. Davenport has been appointed General Ticket Agent of the St. Louis & Southeastern road. Mr. Davenport was formerly connected with the St. Louis, Kansas City & Northern.

TRAFFIC AND EARNINGS.

—The earnings of the Grand Trunk Railway of Canada for the week ending July 13 were: 1872, £34,400; 1871, £31,600; increase, £2,800, or 8½ per cent.

—One hundred cars were ferried across the St. Lawrence River at Ogdensburg, July 30. The *Journal* says this is the greatest day's work ever performed by this ferry.

—The corrected earnings of the Union Pacific Railroad Company for June, are as follows:

	1872.	1871.
Gross earnings.....	\$35,459.47	\$28,174.34
Operating expenses.....	391,666.08	271,132.84
Net earnings.....	\$443,783.39	\$449,051.54

This is an increase of nearly 15 per cent. in gross receipts, an increase of 40 per cent. in working expenses, and a decrease of a little more than 1 per cent. in net earnings.

—The earnings of the Marietta & Cincinnati Railroad for the month of July were: 1872 (approximate), \$149,550; 1871, \$118,572; increase, \$30,978, or 26 per cent.

—The earnings of the Great Western Railway of Canada for the week ending July 13 were: 1872, £30,135; 1871, £18,498; increase, £11,637, or 63 per cent.

CHICAGO RAILROAD NEWS.

South Chicago Locomotive Works.

Several prominent citizens, among them some heavy capitalists, are engaged in forming a company to establish locomotive shops at South Chicago, the new town at the new harbor at the mouth of the Calumet, twelve miles from the center of Chicago, on the Fort Wayne and Michigan Central roads, and about a mile from the Illinois Central. The South Chicago Land and Dock Company (we believe that is the name) has been making extensive improvements there, fitting it especially for the handling and storing of all kinds of heavy materials, whether received by lake or rail. This company offers to give the land needed for the shops and to take \$100,000 of the capital stock, which, to begin with, will probably be \$500,000. There isn't much of a town at South Chicago just now, but the proprietors are making special efforts to secure the establishment of manufactures there, and will afford, we believe, cheap sites for the homes of workmen—a thing which is absolutely essential to the successful manufacture of locomotives; for the chief part of their cost is the labor, and the cost of labor is very greatly affected by the rate of rents. There is a very large and rapidly-growing market for locomotives in the vicinity of Chicago, and if they can be built there as cheaply as elsewhere there will probably be little difficulty in selling them. It is a business, however, requiring a great amount of skilled labor and very careful and skillful business management.

Among the gentlemen interested in this enterprise are Col. James H. Bowen, T. S. Dobbins, Col. R. M. Hough, Hon. Chauncey M. Bowen, O. S. Hough, Charles A. Gregory, and others. Goldsmith B. West, whose office is at No. 374 Wabash avenue, takes general charge of the enterprise.

New Elevator.

The new "Air-Line" elevator, capable of storing 850,000 bushels of grain, and intended to receive from the Chicago & Northwestern, took in its first car load August 1. Work was begun on it just four months before. The "Galena Elevator," of the same capacity and for the same road, will be ready to receive very soon.

Pittsburgh, Fort Wayne & Chicago.

Mr. F. Slataper, the Chief Engineer, will receive proposals at his office in Pittsburgh, until noon of August 15, for the grading and bridging for a second track for this road between Engelwood and South Chicago, a distance of five miles.

OLD AND NEW ROADS.

Pennsylvania—New York Division.

The company began July 15 to build the superstructure of the new bridge over the Delaware between Morrisville and Trenton. The stone piers were erected for the purpose a year or two ago. This is really an addition to the present bridge, being close behind it. All the railroad travel over the bridge has hitherto been accommodated by a single track; and as there are about 116 trains every day it is subjected to pretty severe usage.

Philadelphia & Reading.

This company is erecting, in Reading, Pa., a machine shop 480 feet in length and 185 feet in width, all under one roof. The work on this huge building, the walls of which will be of brick, will be prosecuted rapidly, as the shop is to be completed in two or three months.

Burlington & Missouri River.

The sales of this company's lands in the month of July were: in Iowa, 2,068.23 acres for \$24,243.84; in Nebraska, 10,971.05 acres for \$95,989.24. Total in July, 13,039.28 acres for \$120,233.08. Total sales to August 1, 1872: 2,003 sales in Iowa, 171,618.40 acres, \$2,013,568.20; 1,835 sales in Nebraska, 240,934.12 acres for \$2,048,536.04. Total in both States: 412,552.52 acres for \$4,062,104.34. The company have yet for sale in Iowa about 188,000 acres; in Nebraska, about 1,390,000.

Cincinnati Southern.

The trustees of this road sold, August 1, \$150,000 of 7 per cent. bonds of the city of Cincinnati at 2.55 per cent. premium, the First National Bank of that city being the purchaser. This was the first installment of the \$10,000,000 in bonds to be issued for the road.

Toledo, Wabash & Western.

The *Indianapolis Journal* says that the connection between this road and the Indianapolis, Cincinnati & Lafayette, at Lafayette, has been broken, and the through line west via Lafayette has been abandoned. Heretofore the route from Indianapolis to Kansas City will be over the Indianapolis, Bloomington & Western to Danville, Ill., thence by the Toledo, Wabash & Western. The new route is somewhat shorter than that by way of Lafayette.

Canada Southern.

It is reported that the Wason Manufacturing Company at Springfield have taken a contract for the Canada Southern Railway Company for the building of 50 passenger coaches and 12 mail and baggage cars. The contract amounts to \$330,000.

Missouri, Kansas & Texas.

This company has awarded a contract to the Quealy Car and Iron Works of Hannibal, Mo., for 300 stock cars, 200 box cars, 30 iron turn tables, and 100 dumps. One hundred cars are to be delivered a month until the order is filled.

Indianapolis Rolling Mill.

The stockholders of the Indianapolis Rolling Mill Company, at an adjourned meeting on the 10th inst., authorized the Board of Directors to establish Bessemer steel works in connection with the company's rolling mill, and to that end voted to increase the capital stock \$1,000,000.

Portage Lake & Lake Superior Ship Canal.

The work on this canal is so far advanced that its completion may soon be looked for, and its advantages may be realized this season. A tug-boat drawing seven feet of water has passed from Lake Superior to Portage Lake, and a number of vessels have begun to use the canal.

Franklin & Bellingham.

The town of Franklin, Mass., has voted to raise \$25,000 toward the construction of a railroad to Bellingham, and individuals have pledged subscriptions for \$10,000 more. This short road would be a link in the proposed Rhode Island & Massachusetts road from Worcester to Providence.

Portland & Ogdensburg.

This company now has 43 miles of its Vermont Division in operation: 35 miles from St. Johnsbury northwest to Hardwick, and eight miles from St. Johnsbury east to West Concord, Vt. The iron for the next 17 miles from Hardwick west to Hydepark is purchased, and is to be delivered soon.

Memphis & Little Rock.

Contracts have been let for ballasting the road from Memphis to the St. Francis River, 40 miles, where the road bed is most affected by floods.

Cincinnati, Sandusky & Cleveland.

We learn that the report of the lease of this road to the Cleveland, Columbus, Cincinnati & Indianapolis Railroad Company, made in these columns a short time ago on the positive assertion of another journal, is without foundation.

Eastern Railroad.

At a special meeting of the stockholders of this company, held at Portsmouth, N. H., August 5, the lease of the Portsmouth & Dover Railroad was ratified and the directors were authorized to execute the necessary papers.

Danville, Tuscola & Western.

About 25 miles of the grading is finished and the bridge work is going forward.

Chicago, Omaha & St. Joseph.

A considerable force resumed work on this railroad (late the Iowa Southwestern) August 2, and it is intended to complete the line from Clinton to Oskaloosa soon.

Wisconsin Central.

A telegram from Madison, Wis., dated August 2, says: "Hon. George Reed, in behalf of the Wisconsin Central Railroad, having applied to Governor Washburn for such a certificate that 20 miles on the line of the land grant, from Stevens' Point northward had been completed, as would entitle the company to make a claim on the Interior Department for the land granted by Congress to aid in the construction of the road, a protest was entered from citizens of Neenah and by Mr. Hooper, of Oshkosh, and Mr. A. J. Turner, of Portage, on the ground that the law had not been complied with, especially in not building from Portage or Doty's Island, which were prescribed as initial points. The matter has been taken under advisement by the Governor, and a decision will be rendered early next week."

"Grand Combination."

Bulls and bears on Wall street have been amusing themselves with a story that under the protecting care of Daniel Drew the Canada Southern, Toledo, Wabash & Western and Hannibal & St. Joseph are to be consolidated and then take all the Pacific traffic. The distance to Kearney by this route is 1,654 miles. By a commonly traveled route through Chicago and Omaha the distance is 1,591 miles. A report says: "To accomplish this object is not deemed necessary to buy up the Union Pacific to insure equitable running arrangements, because the charter of the latter contains a wholesome clause which prohibits them from discriminating against connecting lines;" and this in the face of the fact that the Kansas Pacific has never been able to obtain any "equitable running arrangements," or prevent the Union Pacific "from discriminating against connecting lines," unless an arrangement that leaves the Kansas Pacific about ten dollars for the passage from Kansas City to Cheyenne may be called satisfactory. The Union Pacific is not likely to throw away its traffic on 200 miles of its road.

Cairo & Vincennes.

A letter from the Superintendent of Construction of this road says that 3,000 men are now at work on the line of the road; 300 feet of the tunnel has been excavated, and the tunnel will be completed about October 15. The foundations for the Wabash bridge are rapidly going up, and the superstructure is nearly ready. Tracklaying has commenced at three points, Vincennes, Carmi and El Dorado, 25 miles of iron being already laid, and a fourth gang will soon start from Mound City and Cairo. It is expected that trains will be running from Vincennes to Cairo about November 1.

The company having secured the use of a strip of land between Ohio levee and Commercial avenue, belonging to the Illinois Central Company, at Cairo, will enter the city on that line.

New York, New Haven & Hartford.

At a meeting of the stockholders of the Hartford & New Haven Railroad, held at Hartford on the 31st ult., the agreement made by the directors with the New York and New Haven Company was ratified. The capital stock of the two roads, thus consolidated, is \$15,500,000, and the title of the company will in future be the New York, New Haven & Hartford Railroad Company.

Hastings & Dakota.

The track is laid to Young America, Minn., 64 miles west of Hastings, and 16 miles beyond the recent terminus at Carner.

North Pacific Transportation Company.

A telegram from San Francisco dated August 1 says: "The North Pacific Transportation Company has sold its steamers and business from San Francisco to Portland, Victoria, and Sitka to the Oregon Steamship Company, a new organization. The latter company has also bought

all the steamers on the Willamette River. It is understood that this purchase is in the interest of the Oregon & California Railroad Company, and that all receipts are to go to pay the interest on its bonded indebtedness. The Oregon & California Railroad Company practically control, now, all the land and water transportation to and from and in Oregon, and the payment of the interest on its debt is now assured."

Since the purchase is not made by the railroad company, and the steamers are not its property, it doesn't appear evident how they can be security for its debt.

North Pacific.

The company's Yellowstone valley exploring expedition left Fort Rice, Dakota, July 27, Assistant Chief Engineer D. C. Linsley, Division Engineer Gen. T. L. Rosser, and Assistant Engineers Welch, Eckelson and Reed being of the party, which was escorted by twelve companies of infantry, under General Stanley. It has always been supposed that the Indians will resist determinedly any effort to penetrate this valley; but they will have to be not only very determined, but in very large force to drive away twelve full companies, though they may easily make it impossible to make reconnaissances without a heavy force, and make straggling very unhealthy.

Fares from New York to Southern Cities.

The following reductions in the rates of passenger fares between New York and the principal Southern cities have been made, caused, it is reported, by the competition of the steamer lines:

	New.	Old.
New York to Galveston, Texas.....	\$68 75	\$70 25
New York to New Orleans, La.....	50 00	56 25
New York to Mobile, Ala.....	46 00	49 25
New York to Selma, Ala.....	40 00	42 00
New York to Montgomery, Ala.....	40 00	42 00

Muscatine Western.

The contract for building this road from the Iowa River to a point opposite Richmond in Washington County, about 10 miles, has been let to Messrs Adams & Scott, of Muscatine County. Work is to be commenced at once.

Missouri, Iowa & Nebraska.

The line of this road has been located as far as Centreville, Iowa. Contracts are to be let in a few days and the work pushed forward as fast as possible.

Sioux City & St. Paul.

The Governor of Iowa has certified, to the Secretary of the Interior, the completion of 20 miles of this road from the Minnesota line southwesterly toward Sioux City. The road is progressing rapidly, and its officers expect to complete it by September 1.

Russian Orders for American Locomotives.

The Baldwin Locomotive Works are completing an order from Russia for ten locomotives, some of which have been shipped. Six of these are "mogul" engines, with 19x24in. cylinders and 4ft. 6in. drivers, and four passenger engines, with 17x24in. cylinders and 5ft. 6in. drivers.

The Rise in Iron.

Recently the administration of the Belgian State railroads advertised for proposals for supplying rails, etc. The lowest bid was at the rate of about \$55 per ton. Considering these terms too high, the administration again asked for proposals at the end of June, when the lowest bid was at the rate of \$63 per ton.

Winchester & Alabama.

The Nashville (Tenn.) *Banner* says: "Some time ago, the Memphis & Charleston Railroad Company purchased from W. V. Wright & Co. the Winchester & Alabama road, agreeing to give as a bonus \$200,000 of the capital stock of that road. A bill was subsequently filed in our court, on the part of the stockholders of the Winchester & Alabama road, insisting that they were entitled to a participation in the profits derived from its sale. It was recently agreed by both parties to the suit that the \$200,000 in stock or its equivalent in money should be paid into court, and that upon this being done, the Southern Railway Security Company, which assumed the liabilities of the Memphis & Charleston Railway Company, should be relieved of all liabilities so far as the Winchester & Alabama road was concerned, and the sale of this road thus be finally closed. By instructions, the Clerk and Master ascertained the cash value of the Memphis & Charleston Railroad stock to be worth thirty-eight cents on the dollar, and that the total value in money of the \$200,000 in stock was \$76,000. Should the value thus fixed prove to be the minimum price of the stock, money will be paid in preference; but, should it prove to be the maximum, it is thought that the stock will be paid into the court."

"The question which will arise upon the payment of either stock or money will be as to whether all the stockholders were entitled to a participation in the profits derived from the Winchester & Alabama road. This question has already in effect been decided in the affirmative. When it is finally decided, however, Nashville will obtain \$30,000 out of the \$76,000, which, by the by, is no small sum, considering present pecuniary embarrassments."

Muskegon & Big Rapids.

The Big Rapids correspondent of the *Detroit Tribune* says that the consent of the stockholders of this company to a consolidation with the Chicago & Michigan Lake Shore Company has been obtained, and that Mr. Joy has agreed to build the road as soon as the consolidation is effected, the road to be completed by January next. This road would extend from Muskegon, on the Chicago & Michigan Lake Shore road, in a northwesterly direction, to Big Rapids, Mich., about 53 miles.

Wabash & Kokomo.

This company filed its articles of association with the Secretary of State at Indianapolis, July 31. The road is to run from Wabash, or some other point near Wabash, on the Cincinnati, Wabash & Michigan road, southwest through Somerset and Xenia to Kokomo, Howard County, Ind., about 30 miles. The capital stock is to be \$700,000, in shares of \$50. The directors chosen are,

J. R. Nation, John M. Leach, Richard Nixon, S. G. Lane, Calvin G. McGill, T. F. Payne, Solomon Wilson, H. Caldwell, J. G. Clarke, William Anderson, William McLane, J. M. Wright and J. W. Edwards. So far 560 shares of stock have been subscribed for.

Pekin & Mississippi.

Dr. H. W. Krieder, president of this company, reports that the citizens of Peoria have raised \$30,000, the whole amount required. It is expected that the subsidies on the line from Peoria to Fort Madison, Iowa, will all be raised during this month, when work will be pushed forward.

Atchison, Topeka & Santa Fe.

Topeka, Kansas, has voted to issue \$100,000 in bonds to this company, to secure the permanent location of the machine repair and car shops at that place.

Toledo, Canada Southern & Detroit.

This is the name of a new company formed by the consolidation of the Detroit & State Line Railroad Company of Michigan and the Junction Railroad Company of Ohio. The articles of consolidation were filed with the Secretary of State of Ohio August 1. The capital stock is to be \$2,000,000, and of the nine directors one, at least, must be from Ohio.

Leeds & Farmington.

The annual meeting was held July 30, and the final steps taken to complete the transfer of the road to the Maine Central. This latter company has leased and operated the road, since July 1, 1871, previous to which time it was leased by the Androscoggin Railroad Company. This latter company's road is also leased by the Maine Central.

Cincinnati & Pleasant Ridge.

The Cincinnati & Pleasant Ridge Passenger Railway Company has filed its certificate of incorporation with the Secretary of State of Ohio. The termini of the road are at Woodburn and Pleasant Ridge in Hamilton County, and the capital stock is to be \$100,000. The incorporators are John Simkinson, J. M. McCullough, Henry Lewis, J. Slane, James H. Rhodes, John A. Clark, P. F. Lane, S. H. Parvin, C. Hitchcock, E. W. Vanduzen.

Atlantic, Mississippi & Ohio.

It is reported that General Mahone has a party of engineers surveying a line from Bean's Station to Cumberland Gap, with a view of building a road from Bristol to Cumberland Gap, by way of Rogersville and Bean's.

New York & Canada.

The contract for the construction of this road from its southern terminus at Whitehall, N. Y., north to Port Henry, about 40 miles, has been let to George T. Harris & Co., of New York. The price is \$1,400,000, and the work is to be completed by August 1, 1873. The engineers are now surveying north of Port Henry.

Colchester Branch.

The People of Colchester, Conn., intend to build a short branch line to connect with the Connecticut Air Line, as soon as that road is completed. The Air Line Company has agreed to furnish the ties, rails and rolling stock, when the grading is done. The branch will be about four miles long.

Fall of a Bridge.

A Cairo dispatch says that a bridge in course of construction over Cache River for the Cairo & Vincennes Railroad Company fell August 1, killing one man and injuring several others. The accident is attributed to the nature of the ground and the difficulty of obtaining solid foundations.

Milwaukee & St. Paul.

This company has declared a dividend of 3½ per cent. on the preferred stock, payable August 15, for the first half year of 1873. Transfer books are closed on the 10th and reopened on the 16th. It is understood that the company intends hereafter to make half yearly instead of yearly dividends on the preferred stock, which, doubtless, will be preferred by investors.

Texas & Pacific.

Mr. G. M. Dodge, the Chief Engineer, advertises that proposals will be received at his office in Marshall, Texas, up to the 1st of October, for the grading, bridging, tying and tracklaying of about 500 miles of the road, including the "Southern Division," from Longview (the present terminus of the Southern Pacific) west through Dallas to Fort Worth, 155 miles; the "Jefferson Division," from Marshall north by east through Jefferson to Texarkana, 65 miles; the east half of the "Transcontinental Division," from Texarkana west to the crossing of the Houston & Texas Central road near Sherman; the west half of the last-named division, from the Houston & Texas Central road southwest to Fort Worth, 68 miles.

The grading and bridging will be let in mile sections; the tracklaying by the mile; and the ties by the thousand; separate bids to be made for each class of work. The time for completing the grading, tying and bridging varies from 60 days on some sections to nine months on others. Preference will be given to contractors who have outfits on the ground and are ready to begin work within ten days of the letting. Profiles, estimates and specifications can be seen at the company's offices in Marshall and Jefferson, Texas, and at the Pacific National Bank, Council Bluffs, Iowa. Until September 20 bids should be addressed to General Dodge, at Council Bluffs, and after that time at Marshall, Texas.

Western Narrow Gauge.

The Houston (Texas) *Telegraph* says that Mr. T. W. House has been appointed Financial Agent for this company, with full authority to make arrangements with capitalists for the reorganization of the company and the transfer of the control of it, so as to secure the construction of the road.

Chicago, Pekin & Southwestern.

This road is now nearly completed. Construction trains now run west from Sreator and east from Pekin, and very little work remains to be done by the contractors. Passenger trains will soon be put on.

Southern Ohio.

Colonel William H. Trimble, President of this company, which is to build the Dayton Extension of the Chesapeake & Ohio road, says in a letter to the *Dayton Journal*, from Huntington, West Virginia, that "the estimates will be ready within a month for letting the contracts."

Columbus & Toledo.

This company reports that \$650,000 can be raised on the line of the road at once, which amount will be sufficient to make the road ready for the iron, and leave \$200,000 toward buying iron, etc. Strong efforts are being made to induce the company to adopt the route via Delaware, Forest and Findlay.

Columbus & Maysville.

Fayette County, O., having refused to vote \$150,000 in aid of this road, strong efforts are being made to secure the amount from the townships in that county through which the road will pass. Brown County has voted to issue \$173,000 in bonds, which, with \$32,000 voted by Darby township, Pickaway County, and a like amount by Pleasant township, Madison County, makes \$237,000 thus far secured toward the building of the road.

Scioto Valley.

The *Columbus State Journal*, of July 31, says that Judge Dickey has prepared an injunction against the commissioners of Ross County, restraining them from proceeding under the "Boesel law" to expend the money already voted to this and other roads, the grounds upon which the injunction is asked for being the unconstitutionality of the law.

Pickaway County has refused to vote any aid to this road; but Pee-pee township, in Pike County, has voted \$40,000.

Milwaukee, Lake Shore & Western.

The *Sheboygan Times* says that track-laying has been resumed on this road in the town of Holland, and has already reached the county line, 16 miles from Sheboygan.

North Wisconsin.

The engineers have located 25 miles of this line beyond New Richmond.

Milwaukee & Northern.

The *Menasha Press* says that the contractor for clearing the line from Menasha to the junction with the Green Bay line, Capt. Schnellen, has completed his work.

Painesville, Warren & Pittsburgh.

The surveys for this road are about completed.

Ashtabula & Jamestown.

Regular trains will be placed on this road on August 5, to run also over the Jamestown & Franklin road. The roads are operated by the Lake Shore & Michigan Southern Company.

Iowa, Minnesota & North Pacific.

Considerable grading has been done on this road from Fairview to Monroe, including nearly all of the heavy earthwork near Fairview. Nearly all the piles for the bridge over Skunk River have been driven. The main span of this bridge will be 150 feet long, a Howe truss. About 4,000 ties have been cut and distributed along the road. Messrs. Hornish, Davis & Co. are the contractors. The company has secured, between Monroe and the north line of the State, aid to the amount of \$1,000,000 in cash, lands and taxes.

Atlanta & West Point.

The report of the Superintendent of this road to the stockholders of the company, at their annual meeting at Atlanta July 25, shows that for the fiscal year ending June 30, 1872, the gross receipts were \$413,107.85, being a decrease of \$40,607.54 from the previous year. The ordinary expenses were \$274,236.06, and the extraordinary expenses \$58,128.80, leaving the net earnings \$79,742.90. The ordinary expenses were about 64 per cent. of the gross receipts, being about five per cent. increase over the previous year. 103,100 tons of freight were transported, against 76,000 tons last year. The cotton carried was 39,103 bales, against 67,478 bales last year. No dividend was made. The gross earnings amounted to \$4,762 per mile, and the net earnings to \$919 per mile.

Detroit, Eel River & Illinois.

The new route from Detroit to Indianapolis, the opening of which, by the completion of this road, we noticed last week, is composed of portions of five different roads. The cars run over the Michigan Central from Detroit to Ypsilanti, 30 miles; over the Detroit, Hillsdale & Indiana, from Ypsilanti to Banker's (four miles below Hillsdale), 65 miles; over the Fort Wayne, Jackson & Saginaw, from Banker's to Auburn Junction, 45 miles; the Detroit, Eel River & Illinois, from Auburn Junction to Denver, 63 miles; and the Indianapolis, Peru & Chicago, from Denver to Indianapolis, 83 miles, making the whole distance 286 miles. The route to New York from Peru and Indianapolis by way of the new line and Detroit is only two miles longer than by way of Toledo, and it is announced that the Blue Line is putting on 100 cars to run to New York by this line from Indianapolis. We give the stations and distances on the Detroit, Eel River & Illinois road:

Anbure Junction.....	0	South Whitley.....	34
Cedar Creek.....	5	Collamer.....	36
Grand Rapids.....	8	Liberty Mills.....	41
Po-ter's.....	11	North Manchester.....	44
Cherubusco.....	15	Laketon.....	48
Collins.....	19	Roann.....	53
Columbia City.....	26	Chili.....	60
Taylor's.....	30	Denver.....	63

At Grand Rapids Crossing the Grand Rapids & Indiana road is crossed, while the Pittsburgh, Fort Wayne & Chicago is crossed at Columbia City. The extension of the road to Logansport is delayed on account of the refusal of certain towns to carry out their pledges of aid.

Arkansas Central.

The Superintendent of Construction, Col. Gregg, reports that 15 miles of track are laid, and track laying proceeds at the rate of one mile a day. The road is expected to reach White River in thirty days, when business can be commenced. There are now on the road two locomotives, two passenger, twelve flat and six box cars, and

contracts have been made with the Missouri Car Company of St. Louis for thirty-five flat and twenty-eight box cars, to be delivered in August and September. Four additional locomotives are to be built this fall. The bridge across White River, a Howe truss, which is to be completed by October 1, is being built by Beaumont & Curry, of Memphis. As soon as the cars are running to Clarendon, work will be commenced west of White River.

Mississippi City & Memphis.

The *Memphis Appeal* says of this narrow-gauge road that 7½ miles of track have been finished, and the company has two locomotives, five passenger, one mail and 20 freight cars. The company expects soon to have sufficient track laid to secure State aid in the extension of the road to Mississippi City on the Gulf coast.

San Francisco & North Pacific.

The line of this road from San Rafael to Sancelito, about seven miles, is now being located, and work will shortly commence.

Texas & Pacific.

A party of engineers (George Wolcott, Division Engineer, and Wheeler Durham and John E. Thomes, assistants) began work on surveys at Fort Bliss, Texas (on the Rio Grande a few miles east of El Paso), and have run lines on both sides of the river for 25 miles up the stream. Thence the party will work westward by Lieutenant Parke's route. The rear chairman, Philip Mills-paugh, Jr., of New York, was drowned July 10 in crossing the Rio Grande. This party is surveying the line from Fort Bliss to the Pimo Village, on the Gila River, about 400 miles.

One of the engineers of this party had a transit (one of Stackpole's) transported from Chicago to Pueblo, Col., in a baggage car, and thence in the bottom of a freight wagon to El Paso, 620 miles, and when set up the adjustments were perfect. One transit and two levels sent out to El Paso were ruined on the way.

New Connecticut Charters.

During the recent session of the Connecticut Legislature, charters were granted for a new railroad from New Britain to Canton, one from Middletown to Cheshire, and one from Winchester to State Line.

Louisville, Nashville & Great Southern.

Since taking possession of the Nashville & Decatur road, the Louisville & Nashville Company advertises its line under the above name, which is quite appropriate, the company operating lines to Memphis on the west, Lebanon on the east, and besides the trunk line through Nashville to Decatur, Ala., soon to be extended to Montgomery, where it will have direct connections with Mobile and Pensacola.

Baltimore & Potomac.

The following are the stations on this road, the Washington & Alexandria, and the Alexandria & Fredericksburg roads, forming the new line from Baltimore southward:

Baltimore.....	0	Washington.....	40
Winans.....	6	Maryland ave.....	41
Stony Run.....	8	Waterloo.....	43
Severn.....	13	St. Asaph Junction.....	43
Odenton.....	16	Alexandria.....	47
Patuxent.....	19	Franconia.....	54
Bowie.....	22	Long Branch.....	57
Wilson's.....	31	Woodbridge.....	63
Magruder's.....	32	Mount Pleasant.....	65
Benning's.....	34	Cherry Hill.....	70
Navy Yard.....	35	Quantico.....	74

At Quantico connection is made with the new branch of the Richmond, Fredericksburg & Potomac road to Brooke's, 11½ miles. The distance by this all-rail route from Baltimore to Richmond is 156 miles.

Missouri River, Fort Scott & Gulf.

Negotiations are in progress between this company and the town of Fort Scott, Kansas, on the question of locating the machine shops of the company at that point. An election will shortly be held in Fort Scott to decide whether an issue of bonds shall be made to the company.

North Pacific Coast.

A San Rafael (Cal.) date of July 26 says that work was begun that day at White's Hill, six miles west of San Rafael, on the Olema road. From that point the grading parties will work toward San Rafael and Sancelito. This line will connect with the main line two miles west of San Rafael.

Logansport, Crawfordville & Southwestern.

The track has been laid on the section between Camden and Logansport, 15 miles, and the line is now complete, being, with the 23 miles leased of the Evansville & Crawfordville Company, 115 miles long. The financial agents in New York, Messrs. Jones & Schuyler, have advanced the price of the remaining bonds to 97½.

Philadelphia & Erie.

A correspondent writes, under date of August 5, that the Linden line of this road, running on the opposite side of the river from Williamsport, is all graded, and about three miles of the iron laid. The balance (four miles) is now ready for the ties and iron, which are on the ground and will be laid in a week or ten days, when this line will take all the through traffic from the Williamsport line, thereby reducing the wear and tear of the Linden and Williamsport bridges.

Two spans of the new bridge at Linden are finished, and the other five will be finished by the middle or last of September.

Griffin, Monticello & Madison.

A recent report of the President of this company states that the failure of several leading men of the Georgia Railway Contracting Company, which had the contract for building the road, made it necessary for the railroad company to assume the liabilities of the contractors and to prosecute the work. Eighteen miles of grading has been completed, several culverts built and a large number of cross-ties purchased. The road has also been located west from Madison and one and one-half miles of grading done. The whole amount of individual, county

and town subscriptions is \$233,100, of which \$66,277.70 has been collected. The sum of \$53,120.34 has been expended on construction and \$15,733.65 is due contractors. The directors have entered into a contract with D. Calahan & Co. to finish up the first 20 miles and to complete and equip the entire road, should the company be able to fulfill the conditions of the contract, which will depend entirely upon the promptness with which subscriptions are paid up. The road extends from Griffin, Ga., east to Monticello, thence northeast to Madison on the Georgia Railroad, about 60 miles in all.

Hamilton & Lake Erie.

The annual meeting of this company was held in Hamilton, Ont., July 23. The report states that the Chief Engineer, A. H. Askin, estimates the cost of the line, 4 ft. 8½ in. gauge, from Hamilton to Jarvis, at \$532,902, including the grading, bridging and superstructure, as well as wharves, warehouse and elevator at Hamilton. A bonus of \$50,000 has been obtained from Hamilton, \$65,000 from a section of Haldimand County, and \$2,000 per mile from the Ontario Government. The balance of the cost will be raised by stock and bonds. The contract for the grading and superstructure of the second section, from Hamilton to Caledonia, 11 miles, has been let to E. E. W. Plunkett. Mr. John Proctor has the contract for supplying the rails, fishbars, etc., and William McGiverin & Co. furnish the spikes. The company have 400 tons of rails now in Montreal and a large lot on the way from England. Work on the third section, from Caledonia to Jarvis, 16 miles, will shortly be commenced; the fourth section, from Jarvis to Port Dover, seven miles, on Lake Erie, will be proceeded with as soon as possible. The general direction from Hamilton to Port Dover is southwest. Arrangements for running powers over the line have been made with the Grand Trunk, the Great Western and the Canada Southern companies, on satisfactory terms. The agreement will shortly be submitted to the stockholders.

New York, West Shore & Chicago.

Mr. Courtenay, President, and General Stuart, Chief Engineer, of this projected road, recently had a meeting with a committee of citizens of Rochester to consider the question of running the road through that city. The line, as surveyed, passes through Batavia and 14 miles of Rochester. The line through Rochester has been surveyed at the expense of the city, and while the grades are satisfactory, the distance is six miles greater than the original line. No conclusion was reached, though it was stated that the city of Rochester would pay the additional expense incurred by the deviation from the direct line. Mr. Courtenay stated that the company were desirous of putting the Eastern Division, from Jersey City to Catskill, and the Western Division, from Syracuse to Buffalo, under contract this month.

Montreal & City of Ottawa Junction.

The contract for the construction of this road has been signed by Mr. A. McDonald, representing the company, and Messrs. A. L. Catin & Co., an American firm. The contract includes, not only the construction of the road from Ottawa to the neighborhood of the Coteau, where it will connect with the Grand Trunk road, but also the building of a bridge across the St. Lawrence from Coteau village to Valleyfield, whence another road will be built to connect with Rouse's Point, thus placing the city of Ottawa in communication with New York and Boston, by the shortest possible line. The contractors are to take the grant of the Ontario Government, the bonds of the company and the bonuses of the municipalities through which the line passes. In return they engage to furnish the capital required, and to begin work at once, completing 10 miles, and if possible 20 miles this season, and to finish the whole line by January 1, 1875. It is said that the officers of the company were very desirous to avoid the connection with the American cities, as they wished to make Montreal their only seaport. But they were obliged to seek aid from American interests, which was only given on condition that a charter should be obtained to make the line the shortest possible from any point on the Ottawa River, and a point convenient for railroad connections with New York and New England.

Winona & Southwestern.

A meeting of this company was held at Winona, July 29, to consider the question of transferring the charter and franchises of the company to the Green Bay & Lake Pepin Company. No quorum being present, no final action was taken, though the general feeling was in favor of the transfer.

Winona & St. Peter.

The track has been laid six miles beyond the Cottonwood River, 38 miles from New Ulm. A town has been laid out at Bingham Lake, in Cottonwood County.

Speech by Thomas A. Scott.

At New Orleans, recently, Colonel Scott, being engaged in making preparations for the construction of the Texas & Pacific Railway, made the following speech:

I am here to-day, gentlemen, by invitation of your committee, not to make a speech, but to have a little friendly talk on the subject of railroads—railroads that relate immediately to the interests of this city and the State of Louisiana. For the last two or three weeks, accompanied by a committee of the Board of Directors of the Texas & Pacific Railroad, consisting of Colonel Forney, Mr. Walters, General Dodge (Chief Engineer), and others, I have been making a tour through North-eastern Texas, which is the location of the line intended to be built through Texas, near the Thirty-second parallel, and so on to the Pacific coast at San Diego. Having made this visit to Texas, the first time in my life, never having been in that region of the world before, I will state to you very briefly the impressions made upon my mind in relation to that country, its productions, and its peculiar adaptability for the extension of railroad facilities.

We have all been very much surprised at finding a country capable of producing all of the great staples to a degree of perfection that is remarkable. We found there, within a circuit of a very few miles, as good wheat, as good corn, as good tobacco, as good cotton, as good oats, and as much of the acre as I have ever seen standing on the ground in any part of the world. I have no doubt that the State of Texas can produce

and will produce more of these great staples than are now being produced to-day in all the balance of the United States.

My object in coming to this section was to look over the line of the Texas Pacific Railroad, and to make arrangements for its construction; and for this latter purpose I find we can readily obtain all we need; a reasonably strong population in numbers, active people, plenty of timber and water, and a good natural location for the road; and with all these facilities, I will say that the work is about to commence within the next two weeks from this time. Contractors will be placed along the line due west, with a view to extending the road directly through to San Diego and the Pacific; and I think I may say to the people of New Orleans that within the next six years I hope to be able to take them through to San Diego, and perhaps San Francisco, on a train of cars from their own city.

The Texas & Pacific Railroad starts from Shreveport on the one point, Texarkana on the other; and these two lines, running in nearly a westerly direction, will connect at a point known as Fort Worth, in Tarrant County, Texas. We started from Shreveport, the one end of the old Southern Pacific, to the end of that road, and traveled thence by private conveyances, over two hundred miles of that country, every acre of which can be made to produce as I have told you; and Texas can, in my opinion, unquestionably be made the greatest State of this great Union.

We want, in connection with this great enterprise as it progresses—and as it now undoubtedly will—commercial prosperity. We want outlets to New Orleans, to Vicksburg, to Memphis, to St. Louis, and to any other point that will build a road to Shreveport, Texarkana, Jefferson, Marshall, or the vicinity of either, or to any other point that will intersect with us. It strikes me that your people are particularly interested in having a connection with these roads now, as it would benefit you greatly. A connection with that great thoroughfare, which will have five hundred miles completed within the next two years, would be especially desirable, and it is of the utmost importance to your commercial interest.

You need a more reliable connection with Texas than by the Red River and the Mississippi, and I think it is the duty of the people of New Orleans to take up at once the subject of building a railroad to Shreveport to connect with the Texas Pacific. If you construct a line to Baton Rouge, or any other that brings you nearer to our road, you will control a large amount of travel and business that will make it eminently worthy of your consideration. It is not necessary for me to dilate upon what the Texas Pacific will be when it is finished. I believe its route is well understood by the people of New Orleans and Arizona, and so on to California. It will attract to your city a large share of the vast mineral wealth of old Mexico. Its importance cannot be overestimated, and all the work necessary for you, in order to derive great benefits therefrom, is the construction of a road between Shreveport and this city.

After leaving the line of the Texas Pacific road, we started from Dallas and went down, via the Texas Central, to Austin, Houston and Galveston; then by steamer to Brashear City and to New Orleans, via Louisiana & Texas Railroad. In all that country there is now developing a trade a large share of which you should divert to your own city; and you can easily do so by constructing two railroad lines—one to Houston and one to Galveston.

I want to impress upon you as strongly as I can do so the necessity of making these roads, and particularly the road to Shreveport, or to aid organizations that may be formed for such purposes. I do not want you to suppose that I am particularly anxious to be concerned with them, but I do want you to take up the subject, and I do say that I believe three hundred miles of road can be constructed at an expense of not exceeding ten millions of dollars; and it can be done with the aid of two millions from your city and its great population, which will put you in direct communication with all the facilities of the road extending to the Pacific coast.

So far as the Texas Pacific road is concerned, the question has been asked me at least twenty times as to whether it was connected with Eastern lines, and whether it would not tend to divert trade from New Orleans and other Southern ports. In reply to which I state that it is not connected with any interest or any line whatever. It stands a perfectly independent organization, and if the people of New Orleans make a highway to it they shall have as good a chance for its trade as any other people upon earth; and I should like to hear from them on the subject at the earliest moment. We want New Orleans to build a road to connect with the end of the Texas & Pacific, and to take a share of that trade. Will you do so?

Narrow-Gauge Wooden Railroads.

BY HERMANN HAUPT.

The undersigned proposes a system of narrow-gauge wooden railways as feeders to trunk lines in rural districts and sparsely-settled localities, which can be constructed more cheaply than ordinary country roads and upon which transportation can be conducted at less expense than on ordinary railroads.

The system has been tested to a limited extent, and found to answer admirably. The construction—both of track and cars—is characterized by extraordinary economy and simplicity; it presents many novel features, and is applicable to all grades and to any locality.

Track.—The track consists solely of two parallel lines of timber, hewed on the upper and inside faces at right angles to each other; the other two sides may be left rounding or roughly hewed. No cross ties whatever are used, except occasionally where the track is above ground, or crosses streams or ravines. The string pieces themselves form the track, and they are laid in trenches and filled in, so that the top surface is not more than a half inch above the road-bed. The earth packed around them will effectually prevent spreading of the track in ordinary ground, but in soft places a few stout stakes may be driven outside. The joints are lapped and pinned. Streams are crossed by putting trestles or posts under the string pieces, and the track is filled in with timber laid parallel to the rails, and covered with earth or gravel, for a horse path.

Where saw mills are convenient, sawed rails of hard wood may be pinned on the stringers, and renewed when worn out; but with a wide tread of 6 or 8 inches, and wheels of wood, as is proposed, the wear of track will be very slight.

The road-bed may be narrow; the gauge of track not more than 3 feet, and curves of 200 feet radius can be turned with facility. Turnouts will not in general be required, as the cars are so light that they can be run on or off the track with facility wherever the ground is level. The cars will generally be empty, or nearly so, in one direction, and the loaded cars would have right of way. Occasionally turnouts will, however, be convenient.

Cars.—The cars are constructed without springs, and the wheels, which are the most important part, are made of hard wood, with a rim of cast iron for a flange, and treads of 6 or 8 inches to bear on the whole surface of the rail. The cost of a four-wheeled car would be about \$30, and the weight about 800 pounds.

Cost of the System.—The grading in general will cost less than for a common road; and the writer has just finished four miles of graded wagon road alongside a hill, more than usually difficult of construction, at a cost of \$125 per mile; the road-bed 9 feet wide. The grading for a narrow-gauge wooden railroad should cost, in the locality of the writer in the mountains

of Virginia, not more than \$200 per mile; the hewing of the timber, \$100 per mile, and laying, \$75 more—in all, from \$300 to \$400 per mile—assuming timber and right of way to be furnished without charge; if not the cost must be added.

It is assumed that few parties can be found owning lands through which such a road would pass who would not give the right of way freely, and also cut and drag to the line of the road all the timber required for stringers. Many, in addition, would cheerfully undertake to grade the road through their property, taking stock for their consideration. Under such circumstances it is believed that \$300 per mile will cover the cost of the railroad, if no rock excavation is required.

Influence of Grades.—On an ordinary railroad, as the Pennsylvania, with the rolling stock there employed, the traction on a straight and level road is equivalent to 9.2-10ths lbs. per ton; and the angle of friction at which a car would move by gravity is 23 feet to the mile.

The power required to move a ton on a straight and level wooden track can only be determined by experiment with the cars proposed to be used; but it will probably be safe to assume it at 16 lbs. to the ton of 2,000 lbs.; the angle of friction will then be 42 feet to the mile—on which grade the tractive power will be required to be doubled.

If a horse power be estimated, as usual, at 33,000 lbs. raised one foot in a minute, it will be equivalent to the application of a tractive power of 187 lbs. moving at two miles per hour.

Assuming that an average horse will exert a power of 150 lbs. at a speed of two miles per hour, he would move 9.4 tons on a level, 4.7 tons on a grade of 42 feet to the mile, 3.1 tons on a grade of 84 feet, 2.3 tons on a grade of 126 feet, 1.9 tons on a grade of 168 feet, and 1.6 tons on a grade of 210 feet.

The weight of the car would be about 700 lbs.; so that a horse could pull about a ton and a half on a grade of 168 feet, which grade is as high as will be found necessary under ordinary circumstances.

Cost of Transportation.—It has been found that one horse will haul 3,000 lbs., exclusive of weight of car, on a grade of 168 feet, and two horses consequently 6,700 lbs. A team of four horses on an ordinary country road in good condition can haul 3,000 lbs.

The cost of a pair of horses and driver is \$2 per day—say \$2.50; and on a road with undulating grades, the maximum not exceeding 168 feet to the mile, twenty-five miles per day can readily be accomplished. The cost of carrying 6,700 lbs. 25 miles, exclusive of tolls, would therefore be \$2.50, which is equivalent to ten cents per mile for the car and contents, or about three cents per ton per mile. Add one cent per ton per mile for tolls, and the charge would be four cents per ton per mile, to cover all expenses. As compared with wagon transportation, the charge for twenty-five miles, with full loads, is usually fifty cents per 100 lbs., or \$10 per ton—equivalent to forty cents per ton per mile, or ten times as much as the cost on the wooden railroad.

On Virginia railroads, for short distances of fifty miles or less, local freights are charged at rates of six to ten cents per ton per mile.

It appears, therefore, that the cost of transportation, including three cents per car per mile for tolls, would be less than on ordinary railroads, and only one-tenth the cost of wagon transportation on common roads.

If such a road should be fifty miles long, the cost of construction would be covered by \$15,000 to \$20,000; the cars would be owned by individuals. Two men, at \$600 a year, would keep the road in good repair. To cover interest and repairs, would require only \$1,500 per annum. At \$1.50 toll per car, this would be covered by a thousand cars a year, or three cars per day in both directions. It would be difficult, perhaps, to find a location so sparsely settled and so destitute of resources that within two years after the opening of the road less than five cars per day each way would pass over it, and this amount of business would pay a dividend of twenty per cent.

This calculation has been based on freight only, but passengers would be much more remunerative. For a distance of fifty miles the lowest rates would not be less than \$5. But assume a charge of \$4 to a passenger; ten passengers to a car for 100 days during the summer season, and five to a car each way for the balance of the year, and only one car per day each way—the receipts from passengers would be \$16,000. Deduct expenses of ten horses and drivers, \$3,000, leaves \$13,000, which, with the freight tolls, would pay not far from 100 per cent. dividends. Certainly there is margin enough in this calculation to allow the most liberal discount for contingencies and still leave no room to doubt that the investment would be profitable.

Operation.—Although empty or partially loaded cars can be run off the track and replaced at almost any point with facility, yet it will be convenient to have passing places at intervals of half a mile. Passenger cars should have right of track, and, as they will run to schedule, there will be no difficulty in freight cars keeping out of the way. When freight cars meet, loaded cars should have right of way over those which are empty or partly loaded. When both are loaded, the one nearest to a siding should back. The cost of sidings is so trifling that they might be placed at shorter intervals if found desirable. The road could be used as a turnpike or public highway—individuals putting on their own cars and teams and paying tolls. The Philadelphia & Columbia Railroad was operated in this way for some years after its construction.

Such a system of construction and operation of narrow-gauge wooden railways, with light cars and broad wooden wheels, combines so many advantages, so great economy, and such extreme simplicity, that it is believed, for the uses to which they are applicable, no other system can compare favorably with them, and their general introduction will no doubt be rapid in all localities where timber is abundant.

Locomotives with Rubber Tires for Wooden Railways.—Traction engines for common roads with rubber tires have been successfully introduced in Great Britain, and several of them are now being manufactured in the United States. These locomotives would appear to be peculiarly well adapted to wooden railroads such as are now prepared. The adhesion of rubber upon wood on a rail 8 inches broad would be greatly in excess of iron or steel upon iron, on ordinary railroads, and would greatly exceed the cylinder power as engines are now constructed, which is sufficient to slip the wheels on a dry rail.

The traction engines for ordinary roads weigh 6 tons, cost \$5,000, and with the cylinders 6 by 10 inches haul 18 tons gross on inclinations of 1 in 30. Wooden railroads would require an engine specially adapted to their use; they should have four connected drivers, weigh about 6 tons, and run at a maximum speed for passengers of 12 to 15 miles per hour, and for freight 6 miles per hour. In the absence of direct experiment, it may safely be assumed that the adhesion of rubber on a broad wooden rail would not be less than one-fourth the weight, or 3,000 lbs., and at 6 miles per hour would develop a power of 60 horses, and with sufficient cylinder and boiler capacity should haul on a level 188 tons gross, on a grade of 174 feet 44 tons, with a consumption of coal of 100 lbs. per mile, or one ton to 20 miles. At this rate the cost of motive power per ton of gross load per mile on a grade of 1 in 30 would be covered by about one-half a cent, including engineer, fireman, fuel and repairs, while the proportion of paying to dead weight, instead of being 1 to 2, as on ordinary roads, would be probably 2 to 1, or four times as favorable, the cars when fully loaded carrying three-fourths of the gross load of the train as paying freight.

Such a system would probably prove to be as far in advance of the ordinary narrow-gauge roads with iron rails in economy of construction and operation, as these are claimed to be superior

to ordinary wide-gauge roads, and could be introduced even in poor and sparsely settled localities, to furnish an avenue to market for coal, iron, timber or stone.

In the discussion of the merits of wooden railroads with intelligent practical men, some valuable suggestions have been made; one is, to apply such a road to canal propulsion. The wide wooden rails laid even with the surface of the tow path, the locomotive for towing provided with rubber tires or with wooden wheels made in a peculiar manner, which would secure great strength. The track would not interfere with the use of the tow path by horses. An arrangement was also suggested by which flanges could be dispensed with on the drivers, and the engine run off or on the track at the pleasure of the engineer.

Wooden railroads have long been used for various purposes, but they have been constructed of light sawed rails pinned on cross ties. Such roads have not given satisfaction; they soon go to pieces under the action of iron wheels with narrow tread and heavy loads. The peculiarity of the plan now proposed consists in dispensing with cross ties, using a heavy stringer sunk in the ground nearly level with the road-bed as the rail, a very wide surface of 6 or 8 inches for the rail, and an equally wide tread for the wheels. Such roads would be free from the defects of ordinary wooden railroads, and would be so cheaply constructed that no locality need be without a railroad. Their influence in promoting the settlement and development of a new country would be very great.—*Van Nostrand's Engineering Magazine.*

Railroad Gauges and Construction.

We have received from the author a pamphlet containing a letter and other documents addressed to Hon. H. C. E. Childers, M. P., and Agent General of the Colony of Victoria, by Mr. W. W. Evans, C. E., of New York. The letter is in reply to one addressed to Mr. Evans, in which information and advice is asked in reference to railroad gauges to be established in Victoria. We regret that we are not able to find room to republish the whole of the contents of the pamphlet, as it is one of the most pithy discussions of the narrow-gauge question that has thus far come to our notice. After some preliminary remarks Mr. Evans says:

Let us examine some of the leading points in this matter, and try to find out where the economy lies in building and working two railways of different gauges, each having the same kind and amount of business to do, running the same number of trains a day, each train of the same tonnage, and run at the same speed. To make it as favorable to narrow gauge as possible, let both roads be located where heavy inclines and sharp curves are required, and where there is a fair but not enormous business.

It should be understood that on many lines the two rails of a railway are a very considerable portion of the whole expenditure (exclusive of rolling stock), in some cases one-half the whole; it should also be understood that on many lines there is no ballast. This is not, as put down in the evidence you sent me, confined entirely to American and Russian lines, but is the case with lines built and owned by Englishmen. The Central Argentine Railway is a case of the kind; it runs for 247 miles over the Pampas, in rich alluvial deposit, where there is no ballast; this line is nearly straight from end to end. Another railway, the Arica & Tacna, belonging to an English Company in London, and built under my direction in Peru, has no ballast, and does not require any, as the formation is sandy, and every day in the year a bright, sunny, warm day; no rain, ice or frost to encounter as disturbing causes.

I beg now to ask some questions which are simple and can be understood by all who have reasoning faculties and unprejudiced minds.

- 1st. Will it cost any less for the surveys and location of a narrow-gauge line than for one on the standard gauge?
 - 2d. Will it cost any less for land, assuming that the land taken is in all cases a few feet more than the actual positive requirements at the time the railway is built?
 - 3d. Will the ditches required for drainage be any less in size or cost on narrow gauge than on standard gauge?
 - 4th. Will changing channels of streams, or cutting off bends in rivers, cost any less for narrow gauge than for standard gauge?
 - 5th. Will grubbing and clearing cost any less per acre for narrow gauge than for standard gauge?
 - 6th. Will fencing cost any less per mile for narrow gauge than for standard gauge?
 - 7th. Does not and should not the width of carriages and wagons govern the width of cuttings more than the gauge of the track?
 - 8th. Is there any reason why carriages and wagons of any appropriate width of body for narrow gauge cannot be built for and run on standard gauge?
 - 9th. If so, is there any reason why the cuttings should be wider and cost any more for standard than for narrow gauge?
 - 10th. In embankments is there any good reason why they should be any wider for standard gauge than narrow gauge, beyond a vertical longitudinal slice placed in the center, 14 in. wide, the difference between 3' 6" and 4' 8 1/2"? This in an embankment of 50 ft. high, makes 1 1/2 per cent. difference in quantity and cost, but only for so much as is 50 feet high.
 - 11th. Where the line is a surface line, or very nearly so, will there be any difference in the cost of formation between the narrow and standard gauge?
 - 12th. Will the water-way for bridges and culverts be any less in clear space for narrow than standard gauge?
 - 13th. Will the foundations for bridges require to be any less deep for narrow than standard gauge?
 - 14th. If the rolling load is to be the same, would it be safe to build the bridges with less strength for a narrow than a standard gauge?
 - 15th. If the bridges are to be of the same strength, will the cost be any less for the narrow than the standard gauge?
 - 16th. Will there be any difference in the amount of ballast required between narrow gauge and standard gauge, except the difference in the width of the gauges, say 200 cubic yards per mile, at a cost of about £8 to £10? But where will this difference be if there is no ballast?
 - 17th. If the engines are of equal power will they not, if of the same design and general character, be of equal weight and cost for both gauges?
 - 18th. If engines of same weight are used on both gauges, will they not require the same amount of sleeper bearing surface for one gauge as the other?
 - 19th. If it requires 14,000 square feet of bearing surface of sleepers per mile for standard gauge, will it require less for narrow gauge?
- I beg to put in an answer to this. The bearing surface should be more for narrow gauge, for with engines of same power and size of wheels, the elevation of center of gravity in relation to gauge will be greater in narrow gauge than in standard gauge, and, consequently, the leverage will be greater, and cause greater disturbance of surface of track during lateral oscillations.
- 20th. If the same number of cubic feet of timber is used in one gauge as the other, will the sleepers for narrow gauge cost less than sleepers for standard gauge?
 - 21st. If rails of iron or steel, of 40, 50 or 60 pounds per yard, are used, will they cost less per mile for narrow gauge than standard gauge or any other gauge?

22d. I would ask the same question as to fish-plates, bolts, chairs, spikes and screws?

23d. Will switches and crossing-points (supposing each road requires the same number) cost less for narrow gauge than for standard gauge?

24th. Will it cost less for laying and finishing a mile of narrow gauge than a mile of standard gauge?

25th. Will it cost less per mile to sod or seed the slopes of narrow gauge than it costs to do the same on standard gauge?

26th. Will the telegraph lines (now required on all railways) cost less on narrow gauge than on standard gauge?

27th. Can we make the station-yards smaller for narrow gauge than for standard gauge, the amount of business being the same?

28th. Will any one sell land cheaper for narrow gauge than for standard gauge?

29th. Will there be any less or smaller or cheaper station buildings, or turn-tables, or water reservoirs, or derricks, or tools for repairs, or stationary engines, or stores, or extras required for narrow gauge than for standard gauge?

30th. Will the locomotives of same weight and power and material cost less for narrow gauge than for wide gauge?

As this is a question that people generally cannot well answer, I will state that they cannot be built for a less sum, and that when very great power and speed are required, such as we are using on the standard gauge every day, they cannot be built at any price and have the required stability, for there are mechanical difficulties in connection with narrow-gauge engines that cannot be overcome when great speed and great power are required, and this fact is as well known to the engineers of England as it is here. To put wheels of 6 ft. diameter, or cylinders of 20 in. x 24 in., or boilers with 200 lb. flues in them, in a 3 ft. gauge engine, would be simply ridiculous. The above dimensions have often been much exceeded in engines to run on standard gauge.

31st. Is there any sane person who can show any good reason why a railway car (or wagon, as it is called in England) can be built for a narrow-gauge railway to carry 2½ times its own weight, and the same cannot be done for wagons to run on the standard gauge? As this matter of the ratio of dead to live weight in favor of narrow gauge has been so often stated, and so persistently forced upon public notice, and as I began to fear I was not sane upon the subject, as I could not see the thing, although it was in plain English and big print in the *Times*, I went to various engineers and wagon builders, to propound to them this problem relating to dead and live weight, and I found them just as insane as I was; they could not see or believe that there was any good reason. They say that the same wheel will be of the same weight and carry as much if run on narrow as on any other gauge; that the side-sills of car of same size will bear the same if of same wood and distance between supports the same; that if the axles are longer, it must be recollected the floor of wagon is wider for standard gauge and will carry more; the springs, brakes, buffers, couplings, bearings, pedestals, bolts, etc., etc., if of the same size and material, will weigh no more, cost no more and be no less efficient if used in a car or wagon on standard gauge than if used in a car or wagon on the narrow gauge.

32d. Is there any good reason why a 22-inch wheel will not run on the standard gauge as well as on the narrow gauge, under same circumstances of load and speed?

33d. Is there not a very good reason why the 36 and 42-inch wheels in general use in England on standard gauge cannot be used with propriety or safety on the narrow gauge?

34th. Can it be that all the railway world, the people of countries widely separated in distance, language and ways of doing things, have gone wrong and committed the same error, steadily, through more than the third of a century, in increasing the size and weight and power of engines and cars and rails and sleepers and everything belonging to railways? Are we all idiots?

35th. Will there be any less sidings or sidings less in length required for a narrow-gauge than for a standard-gauge railway?

36th. Will there be less brake power required coming down a steep incline on a narrow gauge than on a standard gauge, or less men on the train to handle the brakes?

37th. With cars on the two gauges of appropriate width for each gauge, will not the train on standard gauge carrying the same load be much the shortest train with less wheels and less rolling friction?

38th. If the train on the narrow gauge is much the longest train with more wheels under it, will not the flange friction on very sharp curves be much greater than in the short train on the standard gauge, the angle at which the flanges strike the outer rail being the same in both cases? (This angle is governed by distance of axles apart and not by the gauge.)

39th. Is a long train as easily handled as a short train?

40th. Will a narrow-gauge railway require any less officers and employees than a standard-gauge railway, and can they be got for less pay and salaries?

41st. Can narrow-gauge cars carry horses and cattle as easily and as comfortably as standard-gauge cars?

42d. Has a passenger in a first-class narrow-gauge car the same room to stand in, sit in and sleep in, and the same comfort as he finds in a standard-gauge car?

43d. Will the Parliamentary and legal expenses and taxes be any less on a narrow-gauge railway than on a standard-gauge railway?

44th. Will not a break of gauge occasioning a change of cargo from one set of cars to another create endless confusion and annoyance, besides extra expense, extra damage to goods and additional risk of accidents? If any one doubts this let him read the reports of Robert Stephenson, and other eminent engineers in England, on the subject, or let him start out in this country and gather evidence as he goes West and South, first on a 6-foot gauge, then on a 4 ft. 8½-in. gauge, then on a 4 ft. 10-in. gauge, then on a 5-foot gauge, and I will answer for it he will come home disgusted with the want of uniformity in gauge now existing in this country, and possibly to be made worse by the introduction of various narrow gauges; if this seeker after knowledge is a merchant and happens to see the cargo of a train unloaded from one gauge and loaded on to another, with the usual damage and loss of time, he will on his return seek to find some line with uniform gauge by which to send his goods to the West.

With uniform gauge over a system of various lines of railway intersecting and connecting with each other, there will be much less rolling stock required, and also less station-tracks and station accommodations; engines and engine drivers will lie idle less time; goods will be delivered earlier and in better condition. It is probably putting it at a low estimate to assert that a change of goods, in quantity, will cost in time a day, or, in distance, more than a hundred miles run, in addition to damage and amount paid for the transfer; two sets of cars have to be furnished, and both have to lie idle during the transfer. I beg pardon for saying so much on this point, but it is a vital point. A partner of the late Mr. Brassey, writing to me a short time since, says: "Break of gauge after once being adopted, is the vital point, and one that every country has seen or will see the sad policy of."

An engineer of note, writing to me recently from London, says: "I have just seen a Russian engineer, who has the same opinion of the double-bogie engines and narrow gauge that you have, and thinks they will have no more of them in Russia." If I may be allowed to offer advice, I would most earnestly urge you to not adopt any system calling for a break of gauge; if you are inclined to make a change and repair the error of having adopted a gauge of 5 ft. 3 in., decide to adopt the stand-

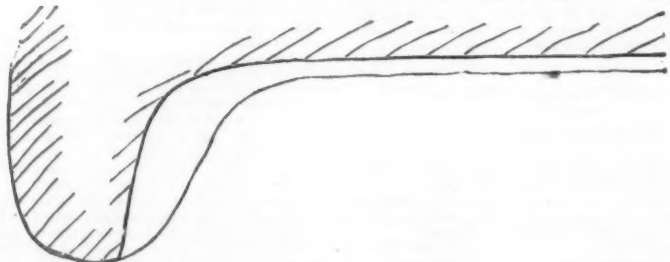
ard gauge, 4 ft. 8½ in.; if a line is required in a rich district now sparsely populated and with small traffic, build it at first with economy, using sharp curves and undulating the gradients, make cuts and embankments narrow, put down a light rail and sleeper and no ballast, equip it with light rolling stock, use the bogie system of American carriages and engines (but not the double-bogie engine); use the American cast-iron chilled wheel as a great economy. All these things can be made in England as well as here, and much cheaper. You can, as circumstances call for it, ballast the road, flatten the curves, and improve the gradients, lay down heavier rails, and put on them heavier and more powerful engines, and improved carriages and wagons, without interrupting travel or traffic. We have followed this system for many years, and find it the only system that would insure us success.

The Parliamentary evidence sent me contains many opinions and assertions in reference to the double-bogie engine, the so-called Fairlie engine. As there has been so much said and written and claimed for this engine, it may be proper to give a little history of this type of engine. The first double-bogie engine ever built was after the design of W. Chapman; it was built and set to work on a colliery railway running to the river Wear in December, 1832; it is described in Luke Herbert's *Cyclopedia*, London, 1836. The next double-bogie engine was designed by Horatio Allen in 1830, for the South Carolina Railway, and built in 1831. See *RAILROAD GAZETTE*, March 4, 1871; I send you a copy. The next attempt at double-bogie engines was designed by John Cockerell at Serravallo; it was called the Serravallo, and built in 1851 to compete for the prizes offered in Austria, for engines to work the Semmering incline in the Noric Alps; it proved, like the two already mentioned, a failure, coming in third-best, the Bavaria taking the prize of 20,000 ducats, and the Newstadt the prize of 10,000 ducats. The Serravallo was, in all its main features, identical with the so-called Fairlie engines (see Herr Engerth's work on those Austrian trial engines, published in 1854; also *London Engineering*, vol. i., p. 84, where all the particulars can be found). The next attempt at double-bogie engine was, I believe, by Jean Jacquier, at Muhlhouse, in France, for the Orleans Railway. It was a failure. Then it was again invented by Petit for the Great Northern of France, and again proved a failure. Years after all these trials of double bogie, and when the world had about forgotten there ever was such a thing, Mr. Fairlie takes it up and claims it as his own, and makes, if not a success, a great noise; in every country of the railway world we hear and see and read much of the wonderful performance of this wonderful engine. If mere words could make facts, we should have looked no further, but cried out "Eureka," and at once proceeded to build double-bogie engines. But, unfortunately, or fortunately, there are in this age some horrid skeptics, who will be prying into the merits and demerits of all things new, asking questions, trying experiments, and getting at facts from comparative results.

Being a skeptic, but a believer in figures, and anxious to see comparative results, I took the data published of trials of two of the so-called Fairlie engines in England (witnessed by the most eminent titled gentlemen that could be assembled), and compared their data with similar data, which I happened to have, of two engine trials in South America, on railways I am interested in; reducing the data and compiling it, until I got at the foot-pounds of work done per hour by each engine. In lifting trains alone (exclusive of engine), for each ton of weight on driving-wheels, calculated from weight of train, speed and elevation overcome, I found the following figures before me:

FAIRLIE ENGINES.		AMERICAN ENGINES.	
Little Wonder.	Progress.	San Bernardo.	Conquistador.
9,094,739	9,372,939	41,557,040	25,377,544

I send with this a copy of the whole data used in these comparisons, which contains also the duty performed by each engine. Calculated from resistances, these figures include the engine.



An eminent mechanical and civil engineer in London wrote me recently as follows, in reference to the double-bogie engine: "It is not what an engine can do at a spur, but what it can do year after year in hauling a maximum load, with the minimum cost for repairs and fuel."

Mr. Fairlie and his agents have repeatedly asserted that his double-bogie engine has no oscillations, and but little flange friction. In the *RAILROAD GAZETTE* of April 13, this year, Mr. Fairlie has a long letter explaining why one of his engines for Mexican Railway did not make the steam required on her trial trip in England. In this letter he claims great saving of fuel by the use of his engine over English engines on various railways, and also on the Iquique Railway in Peru, where his much-talked of engine, the "Terapaca," is running. He says she is hauling twice the loads hauled by the Rogers American engines, and with the same amount of fuel burned. It appears from a report I have just received from that railway through a gentleman in Peru that the Fairlie engine, weighing over 60 tons on the drivers, is hauling up the steep gradients of that railway only as much load as is carried up by the Rogers American engines of 34 tons, with 27 tons on the drivers, and that she is burning twice the amount of fuel to do it. This report also shows that the flange frictions of the "Terapaca" have been so severe as to wear the flanges to a knife-edge in 130 days running, that there has been much trouble with her steam-pipes, and that she jumped the track, doing herself much injury. I send a copy of this report, marked Appendix E.

I had asked a gentleman in Peru to get me information in reference to these engines, and to be sure to send me a true statement. The letter and table in Appendix E is what he sent me, and can be relied on.

I have seen a letter from the Locomotive Superintendent of that line of April this year, to the Rogers Company, asking for information about heavy tank engines and saying: "We have two of your engines here, and doing good work, in fact, fully as good in proportion to the amount of fuel and water as the much-talked of Fairlie engine 'Terapaca.' I think I can safely say that no two engines on the South American coast have done as much work as these two, with so small an expense in repairs, etc., in the time they have been running."

The above report and extract of letter do not appear to war-

rant Mr. Fairlie in publishing what he did in the *RAILROAD GAZETTE*.

While I am writing, a gentleman just from Mexico has come in and given me the following notes in reference to the Fairlie engine, now running on the Mexican Railway, which line he is connected with:

"The Fairlie engines are deficient in steam-generating properties; they cannot carry their water well. One of them burned a number of her flues in the first month. The trains run up the road are twenty 4-wheeled wagons of 6½ tons, with 6 tons of load on each, making a total of 245 tons. This train is taken up the road by a Fairlie engine, assisted by a French engine of 52 tons on drivers, cylinders 20 in. x 24 in.; the distance run from Paso del Macho to Fortin is 23½ miles, the gradient 2½ per cent. (1 in 40), the time 4 hours, but often it takes 5 hours. The track is not yet run on to the 4 per cent. gradients (1 in 25)."

Query. Which engine hauled the train, or did the largest amount of work?

The English manager of that line writes me, June 8, 1872, about this Fairlie engine, as follows: "We run the engine as sent out two trips, and then were compelled to make alterations before we could obtain anything of a result."

APPENDIX E.

Letter from one of the Engineers of the Iquique Railway, Peru, to a gentleman in Peru, who had asked for information in reference to the engines on that railway, and particularly as to Fairlie's engine, the Terapaca.

Iquique, April 18, 1872.

We have a great deal of trouble with the steam-pipes of the "Terapaca"; it is almost impossible to keep her more than three or four days on the road without their giving out. She has only been running about five months, and we have had to put on new side-rod brasses, as the old ones had worn out so much we were afraid they would fall off. We cannot run the engine above a month longer, on account of the tires, which are worn down at the flanges as sharp as a knife edge; in fact, it is dangerous to run the engine at the present time. The great trouble with the "Terapaca" is, that on an incline of 4 per cent. (1 in 25) her down-hill engine works a great deal of water, while she shows only 1½ to 2 of water in her glass; consequently, her up-hill engine tubes (the top rows) are without water, while the down-hill engine is deluged.

The "Carmen" run one year to a day, from the first day we had steam on her till the day we stopped her to take her wheels out to be turned. During that time she did not lose a day for repairs of any description, and even then we found it entirely unnecessary to do anything to her motion—her side-rod brasses and main-roads were in as good condition as when new; in fact, any wear was not perceptible with the eye or calipers.

The "Moro" has done nearly the same amount of work as the "Carmen," and as yet we have not found it necessary to take her wheels out or do anything to her brasses; the valves have been faced once.

The inclosed tracing of cross-section of tire shows the conditions of the tires of the "Terapaca," after having run one hundred and thirty days. No. 1 shows the flange when new; No. 2 the leading and trailing wheels at date. We are obliged now to take her wheels out to be turned off; also, have to put in four new steam-chests, as three of them burst before she had run three months, from being altogether too light castings; one of them is broken so as to be entirely useless. She jumped the track about the 8th of this month, and broke the steam-chest and steam-pipe leading from the dome to the center of the bogie, also her reversing gear. It will cost about \$2,500 to \$3,000 to put her in good running order again. Bear in mind that at the time she ran off the track it was not a very bad run-off, but one that might happen to any other engine without one-half the bad effects. In fact, when the "Moro" ran off and fell over on her side she did not suffer one-third the damage that the "Terapaca" has by simply dropping on the sleepers.

N. B.—The Superintendent of the Iquique Railway wrote me of the accident to the "Moro," said she was tumbled off the mountain side by the act of a drunken driver, and that she fell over 30 feet. The maximum gradient on this railway is 1 in 25, the least radius of curvature 358 feet. The elevation overcome on the first 14 miles is 2,300 feet. W. W. E.

Table Showing Performances of Engines on Iquique and La Noria Railway.

ROGERS ENGINE "MORO."									
1872.	Stations.	Miles.	Loaded Cars U. P.	Empty Cars Down.	Locomotive in Tons	Water Consumed in Pounds	Coal Consumed in Pounds	Remarks.	1873.
Jan 7	Iquique to Noria...	38	4	18	8	3,850	8,800		
13	St. Rosa	17	4	18	8	3,350	4,000		
14	"	38	5	18	8	3,750	4,800		
14	St. Rosa	17	4	18	8	3,750	4,800		
21	Iquique	38	6	20	24	3,450	3,700		
ROGERS ENGINE "CARMEN."									
1	Iquique to Noria...	34	6	16	22	4,150	4,500		
11	San Juan	11	13	13	6	3,350	4,000		
13	"	38	5	18	8	3,450	4,100		
22	"	38	4	20	24	3,450	3,700		
22	San Juan	11	13	13	6	3,350	4,000		
FAIRLIE ENGINE "TERAPACA."									
4	Iquique to Noria...	38	13	22	7,500	9,000		Had to double on grade below Tongoy 3 per cent.	
4	San Juan	11	13	13	6	3,350	4,000		
8	Iquique	38	5	18	8	3,750	4,800		
8	San Juan	11	13	13	6	3,350	4,000		
19	Iquique	38	6	11	12	6,400	7,800		
22	"	38	14	14	14	6,400	7,800		

The above was copied from the daily "guías" (accounts) on conductor's note-book.